BLM

United States Department of the Interior
Bureau of Land Management
Royal Gorge Field Office
3028 E. Main Street
Cañon City, CO 81212

ENVIRONMENTAL ASSESSMENT

Peaks Federal K27-69-HN and Heitman Federal K27-79HN APDs

DOI-BLM-CO-F02-2014-006 EA

February 2014

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ACRONYMS AND ABBREVIATIONS

AO	Authorized Officer
APCD	Air Pollution Control Division
APD	Application for Permit to Drill
APE	Area of Potential Effect
BLM	Bureau of Land Management
BMP	Best Management Practice
°C	Degrees Celsius
CAA	Clean Air Act
CARMMS	Colorado Air Resource Management Study
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
COA	Conditions of Approval
COGCC	Colorado Oil and Gas Conservation Commission
dBA	decibel
EA	Environmental Assessment
EFM	Electronic flow meter
EIS	Environmental Impact Statement
ESA	Endangered Species Act
°F	Degrees Fahrenheit
FLPMA	Federal Land Policy and Management Act
GHG	Greenhouse gas
GPM	Gallons per minute
HAP	Hazardous air pollutant
ID	Interdisciplinary
IM	Instruction Memorandum
MBTA	Migratory Bird Treaty Act
mcf	Million cubic feet
MSDS	Material Safety Sheet
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
N_2O	Nitrous oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxide
NRCS	Natural Resources Conservation Service
O_3	Ozone
Pb	Lead
PILT	Payments in lieu of taxes
PFYC	Potential Fossil Yield Classification
PSD	Prevention of Significant Deterioration
RGFO	Royal Gorge Field Office
RGPA	Royal Gorge Planning Area
ROD	Record of Decision
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur dioxide
T&E	Threatened and Endangered
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile organic compound

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CHAPTER 1 - INTRODUCTION

1.1 Identifying Information

CASEFILE/PROJECT NUMBER: DOI-BLM-CO-F02-2014-006 EA

PROJECT TITLE: Noble APDs for the Peaks Federal K27-69-HN and Heitman Federal K27-79HN Wells

PLANNING UNIT:

LEGAL DESCRIPTION: Weld County, CO
Township 4N, Range 66W, Section22 (Peaks K27-69-HN)
Township 4N, Range 66W, Section27 (Heitman K27-79HN)

APPLICANT: Noble Energy, Inc.

1.2 Introduction and Background

Background: The Royal Gorge Field Office (RGFO) of the Bureau of Land Management (BLM) has received two Applications for Permits to Drill (APDs) from Noble Energy, Inc. (applicant). This Environmental Assessment (EA) has been prepared by the BLM to analyze environmental impacts of the construction of well pads, access roads, pipelines, and the drilling of two horizontal oil wells. Both wells would be drilled on private surface estates over private minerals under existing federal leases held by the applicant in order to produce federal and private minerals (fee/fee/fed). The proposed well pads are located in the south western part of Weld County, within 10 miles of Greeley, Colorado. The federal mineral estate within the project boundary is leased and subject to oil and gas development.

1.3 Purpose and Need

The purpose of the action is to provide the applicant the opportunity to develop their leases for the production of oil and gas. The need for the action is to develop oil and gas resources on Federal Lease COC 52545 consistent with existing federal lease rights provided for in the Mineral Leasing Act of 1920, as amended, the Onshore Oil and Gas Leasing Reform Act of 1987, and the Energy Policy Act of 2005. Drilling and producing the subject wells would penetrate federal mineral estate, which is the federal nexus requiring the preparation of this EA.

1.4 Decision to be Made

The BLM would decide whether, and under what terms and conditions, to approve the proposed Peaks K27-69-HN and Heitman K27-79HN APDs project (Proposed Action) based on the analysis contained in this EA. This EA would analyze the construction of well pads, associated production facilities, access roads, pipelines, and drilling of two horizontal oil wells on private surface estates over private mineral estates in order to produce federal and private minerals (fee/fee/fed). Access to the proposed well pads would be primarily on existing county and rural roads, with short access roads to each of the two well sites. Refer to Chapter 2 for more detailed information about the Proposed Action.

The BLM Washington Office Instruction Memorandum (IM) No. 2009-078 established policy and procedures for processing federal APDs for horizontal drilling into federal mineral estate on non-federal

locations (applicable to this EA). This EA addresses the potential effects of anticipated construction, operation, abandonment, and removal of all wells and other facilities associated with oil and gas exploration.

1.5 Plan Conformance Review

PLAN CONFORMANCE REVIEW: The Proposed Action is subject to and has been reviewed for conformance with the following plan (43 CFR 1610.5, BLM 1617.3):

Name of Plan: Northeast Resource Area Plan and Record of Decision as amended by the Colorado Oil and Gas Final Environmental Impact Statement (EIS) and Record of Decision (ROD)

Date Approved: 09/16/86 amended 12/06/91

Decision Number: O&G Resources, Issue 21

Decision Language: "These 210,410 acres of surface and subsurface may be leased and developed for oil and gas with the standard stipulations included in the leases and standard site-specific stipulations included in any use authorization."

1.6 Scoping, Public Involvement and Issues

NEPA regulations (40 CFR §1500-1508) require that the BLM use a scoping process to identify potential significant issues in preparation for impact analysis. The principal goals of scoping are to allow public participation to identify issues, concerns, and potential impacts that require detailed analysis.

Persons/Public/Agencies Consulted: The federal mineral estate parcels being accessed with this action were scoped and made available for public comment during the leasing process. Scoping for the current action occurred through posting on the BLM NEPA website.

Issues Identified: No issues were identified during public scoping.

CHAPTER 2 - PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

The BLM received two Applications for Permits to Drill (APDs) from Noble Energy, Inc. These APDs propose the construction of a two well pads, associated production facilities, access roads, pipelines, and the drilling of two horizontal oil wells on private surface estates over private mineral estates in order to produce federal and private minerals (fee/fee/fed) associated with existing federal leases in the south western part of Weld County, within 10 miles of Greeley, Colorado. The federal mineral estate in the vicinity of the proposed surface locations is leased and subject to oil and gas development.

The project area is generally rural farmland and located in the northern portion of the South Platte River Basin. The area is primarily used for crop production and oil and gas production. There are few county roads in the project area and there is one state highway nearby. Most access is limited to private roads or petroleum field roadways. Extensive oil and gas development has occurred in the nearby Wattenberg field, mostly on a private mineral estate.

Both of the proposed wells are within an ozone nonattainment area; therefore, a general conformity analysis for ozone has been completed for the proposed activity. Potential emissions of volatile organic compounds (VOCs) and nitrogen oxides (NOx) have been calculated and analyzed in order to determine their conformity with the applicable laws and statutes.

2.2 Alternatives Analyzed in Detail

2.2.1 Proposed Action

The Proposed Action is to construct well and production pads and associated infrastructure, including pipelines and production facilities, on private lands in order to horizontally drill wells and develop private and federal minerals from a private surface. It also encompasses all drilling and completion operations, production operations, and interim reclamation measures. Although these pads would include multiple wells, only one well on each of the proposed well pads would penetrate and drain federal minerals; the remaining wells would drain private minerals and the impacts associated with these private actions are discussed in the cumulative effects section of this EA. The Proposed Action would be implemented consistent with the terms of Federal Lease COC 52545 as well as with any Conditions of Approval (COAs) attached to the APDs by the Colorado Oil and Gas Conservation Commission (COGCC) and the BLM. Figure 2-1 shows the general location of the Proposed Action.

The proposed well locations are primarily accessible from existing roads, with limited need for improving existing roads or constructing new access roads. Construction of the pads and associated infrastructure would result in approximately 22 acres of temporary surface disturbance, which would be reduced to less than seven acres after interim reclamation. The APD package for each well includes a drilling program and a multi-point surface use and operations plan that describe details of well pad construction and interim and final reclamation.

Water for both wells would either be delivered by truck from an existing approved water source or delivered through a temporary surface line from a pond on adjacent private property; no new water wells would be drilled for this project. The proposed drilling and completion would utilize a closed loop system; no reserve or storage pit is being proposed. All water and oil would temporarily be stored onsite.

Produced water would be trucked away and disposed of at a permitted water disposal facility in the area, and drill cuttings would be disposed of at a permitted mud farm in the area. All oil produced from the wells would be trucked and transported daily to one of several facilities.

Interim reclamation would entail backfilling, leveling, re-contouring, and seeding (or re-planting) of areas not needed for production activities, per the approval of the land owner. Leftover top and sub soil piles not used in the interim reclamation would be stabilized in order to prevent erosion. In the event of a dry hole, the well would be plugged and abandoned, pads and access roads would be graded to original contour, topsoil replaced, and the entire area reseeded (or re-planted) for final reclamation, per the approval of the land owner. Upon final abandonment of the wells at the end of the wells' production life, all facilities and surfacing materials would be removed; all road and pad areas would be re-contoured and reseeded (or re-planted), per the approval of the land owner. The wells would also be plugged and abandoned per COGCC and BLM regulations.

Peaks K27-69-HN

The Peaks Federal K27-69-HN well would be located in the southeast corner of T4N R66W Section 22 in Weld County. Access to the proposed well site is from Highway 85. From the intersection on Highway 85/ County Road (CR) 42, access to the site can be accomplished by heading east for 0.5 mile to an existing access road, following the access road approximately 650 feet, then turning right on another existing access road to the proposed well site, or alternatively continuing another 700 feet to the proposed production facility site. The existing access roads have a permanent 20-foot wide running surface. No new access roads would be required for the Peaks K27-69-HN well. Figures 2-2 and 2-3 show the surface locations of the proposed wells, the wellbore path and bottom hole locations, and the associated infrastructure associated with both wells. Table 2-1 shows the temporary and permanent surface disturbance by project element for both well pads and associated infrastructure.

There is an existing well in proximity to the Peaks K27-69-HN well site; the proposed well would be offset by 47 feet to the west. The proposed well pad would contain the proposed new wellhead, an existing wellhead, and possibly a pump jack. Flowlines (carrying gas, water, and oil) would be installed for a distance of approximately 1,000 feet from the wellhead to the production facility. The proposed production facility would accommodate the required infrastructure for the Peaks K27-69-HN well, including a compressor, separators, oil and water tanks, and VOC combustors. After reclamation, the permanent surface disturbance associated with the well pad and production facility would be approximately one acre and 0.6 acre, respectively.

A natural gas pipeline would be installed parallel and adjacent to the access road from the production facility to a connection with an existing natural gas gathering system, for a distance of approximately 1,323 feet. Following installation, the pipeline construction areas would be reclaimed per approval of the land owner; therefore, there would be no permanent surface disturbance associated with installation of the pipelines.

The anticipated construction start date for the Peaks K27-69-HN well is third-quarter 2014, with production to commence in fourth-quarter 2014. Drilling is anticipated to last 10 days, and completion is anticipated to last up to seven days.

Heitman K27-79HN

The Heitman Federal K27-79HN well would be located in T4N R66W Section 27 in Weld County. Access to the proposed pad is from Highway 85. From the intersection of CR 31 and CR 40, the well site would be accessed by traveling north 0.2 miles on CR 31 to an existing access road, then continuing east on that existing access road for approximately 730 feet to a new, proposed access road that would head south for approximately 620 feet to the new well site. The existing access road would be upgraded from 12 feet to a permanent running surface of 20 feet. Due to the location of the new access road being within an irrigated field, the majority of this 620-foot temporary access road would be removed completely after construction. Table 2-1 shows the temporary and permanent surface disturbance by project element for both well pads and associated infrastructure.

There is an existing well in proximity to the Heitman K27-79HN well site; the proposed well would be offset by 47 feet to the north. After reclamation, the permanent surface disturbance would be approximately 0.8 acre. Flowlines would be installed from the wellhead to the existing Nelson/Heitman production facility, which is a multi-well facility proposed for expansion to accommodate additional equipment, with a permanent surface disturbance of 4.3 acres.

A natural gas pipeline would be installed parallel and adjacent to the access road from the production facility to a connection with an existing natural gas gathering system. Following installation, the entire pipeline right-of-way would be reclaimed per approval of the land owner; therefore, there would be no permanent surface disturbance associated with installation of the pipeline.

The anticipated construction start date for the Heitman K27-79HN well is third-quarter 2014, with production to commence in fourth-quarter 2014 or first-quarter 2015. Drilling is anticipated to last 10 days, and completion is anticipated to last up to seven days.

Table 2-1. Surface Disturbance Associated with the Proposed Action

Project Element	Peaks K27-69-HN		Heitman K27-79HN	
	Temporary (acres)	Permanent (acres)	Temporary (acres)	Permanent (acres)
Access Road	0	0	0.5	0
Well Pad	5.9	1.0	4.2	0.8
Flow Lines	0.1	0	0.2	0
Production Pad	1.9	0.6	6.2	4.3
Pipeline	1.0	0	1.5	0
Totals	**8.9**	**1.6**	**12.6**	**5.1**

Figure 2-1. Regional Map

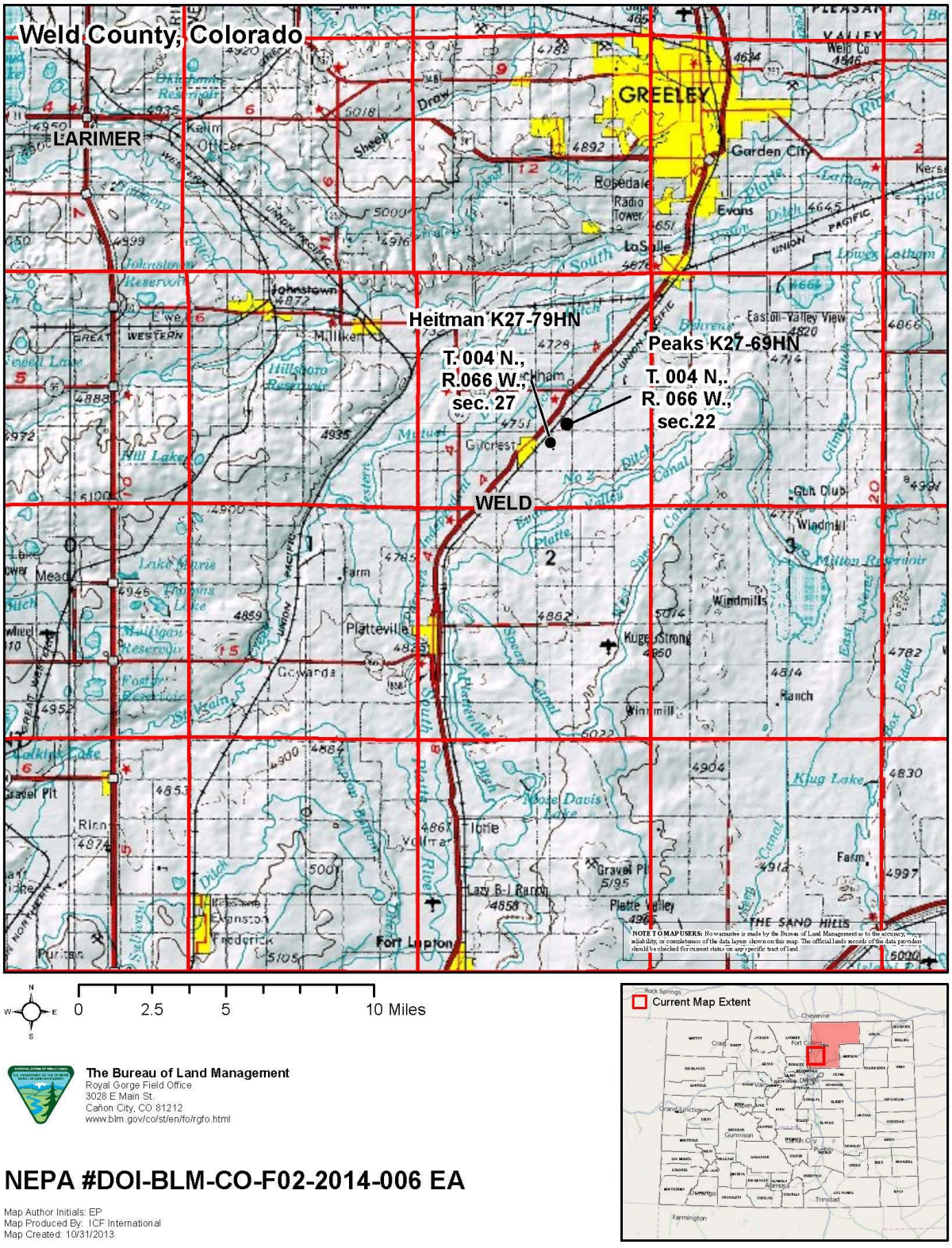


Figure 2-2. Topographic Map of the Proposed Well Sites

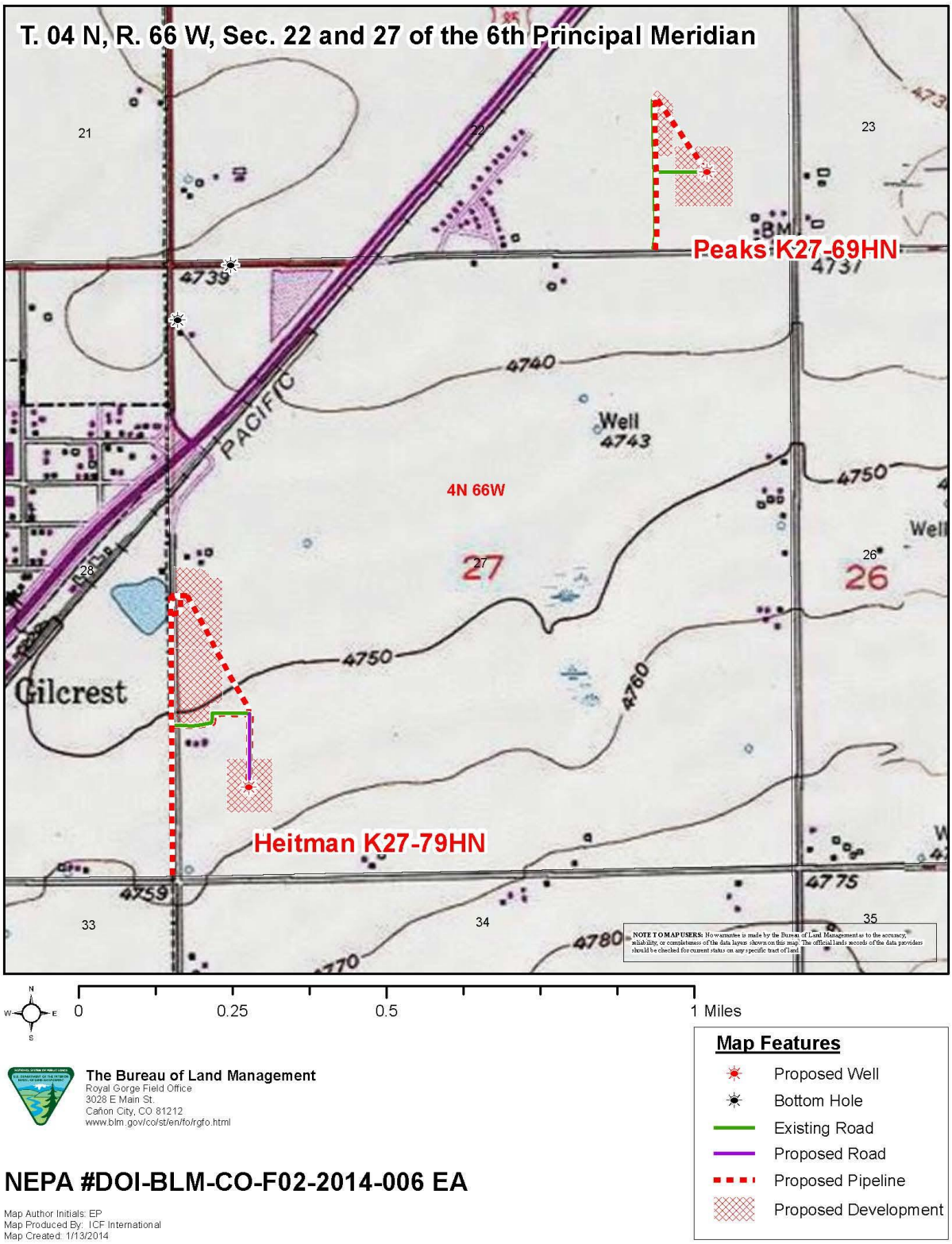
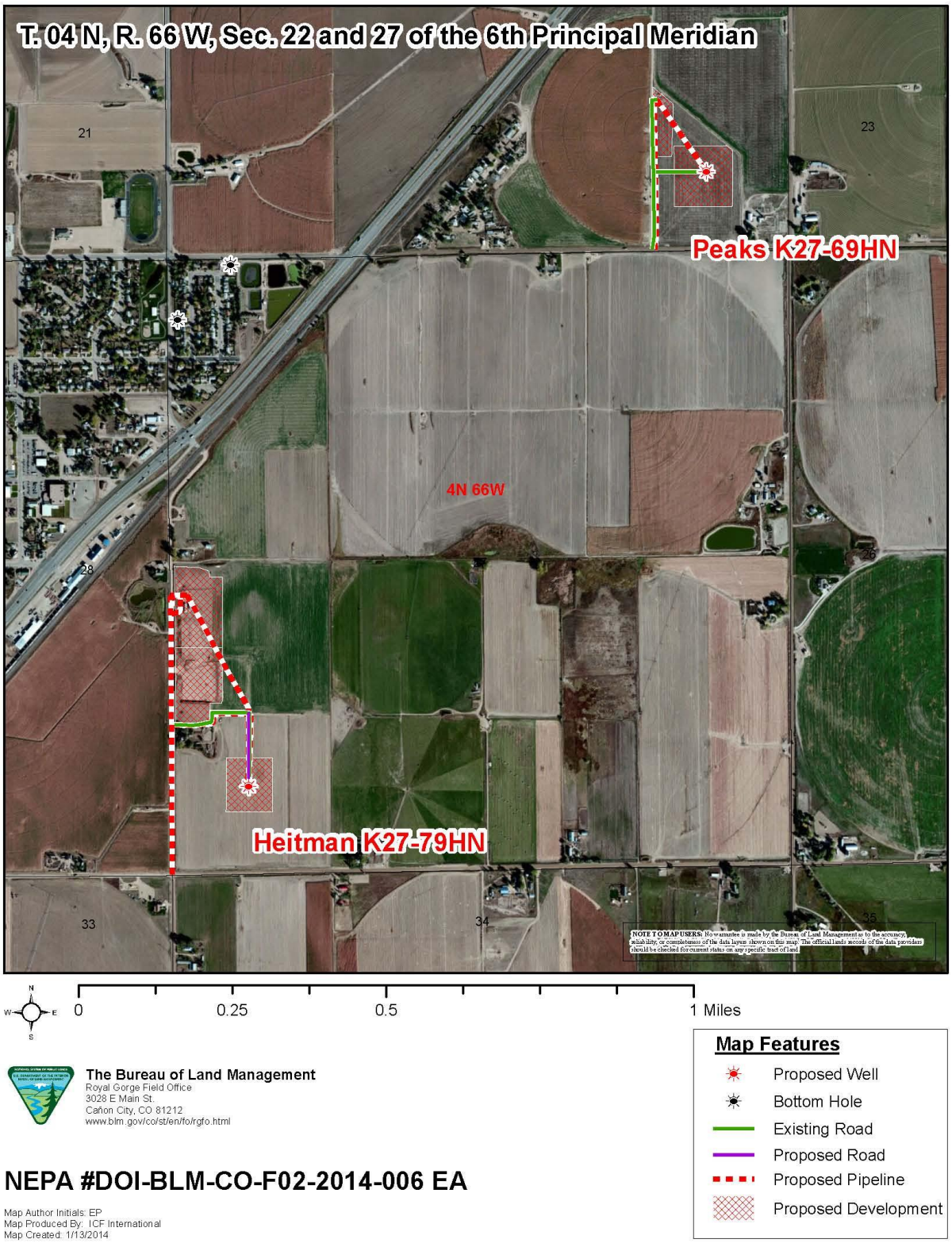


Figure 2-3. Aerial Photograph Map of the Proposed Well Sites



2.2.2 No Action Alternative

The Proposed Action involves drilling on private surface estates over private mineral estates in order to produce federal and private minerals (fee/fee/fed) associated with existing federal leases, which grant the lessee a right to explore and develop the leases. Although the BLM cannot deny the right to drill and develop the leasehold, individual APDs can be denied. The No Action alternative constitutes denial of the APDs associated with the Proposed Action. However, under the No Action alternative, the applicant could explore and develop the private land and private minerals stopping short of the federal minerals with the proposed two new wells.

2.3 Alternatives Considered but not Analyzed in Detail

No other alternatives were considered.

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CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.1 Introduction

This section provides a description of the human and natural environmental resources that could be affected by the Proposed Action and No Action and presents comparative analyses of the direct, indirect, and cumulative effects on the affected environment stemming from the implementation of the actions under the Proposed Action and No Action alternatives. The Project Area is defined as the area on which construction and operation of the proposed access roads, pipelines, well pads, and production facilities would occur. The Proposed Action Project Area is depicted on Figure 2-2.

3.1.1 Interdisciplinary Team Review

The BLM RGFO interdisciplinary team (ID team) conducted internal scoping by reviewing the proposal, its location, and a resources/issues list, to identify potentially affected resources, land uses, resource issues, regulations, and site-specific circumstances (refer to the administrative record [AR] for this list). This EA does not discuss resources and land uses that are not present, and briefly addresses those resources that are present but not managed by the BLM due to the private surface over private mineral estate ownership for the Proposed Action.

The following issues are analyzed in detail in this EA:

- Air quality
- Geologic and mineral resources
- Water resources
- Migratory birds
- Threatened, Endangered, and Candidate species
- Cultural resources
- Native American religious concerns
- Paleontological resources
- Wastes, hazardous and solid

The following resources are present but not managed by the BLM due to the private surface over private mineral estate ownership; therefore, these issues are addressed briefly in this EA:

- Soils
- Vegetation
- Invasive Plants
- Terrestrial wildlife
- Socioeconomics
- Noise

The following resource issues are not present, or are not managed by the BLM on private surface; therefore, they are not included in this EA:

- Visual resources
- Recreation
- Environmental justice
- Farmlands, prime and unique
- Lands and realty
- Wilderness areas
- Range management
- Forest management
- Cadastral survey
- Fire
- Law enforcement

3.2 Physical Resources

3.2.1 Air Quality and Climate

Affected Environment

The Clean Air Act (CAA), which was last amended in 1990, requires the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS), codified by 40 Code of Federal Regulations (CFR) Part 50, for criteria pollutants. Criteria pollutants are air contaminants that are commonly emitted from a variety of sources and include carbon monoxide (CO), lead (Pb), sulfur dioxide (SO_2), particulate matter smaller than 10 and 2.5 microns (PM_{10} and $PM_{2.5}$, respectively), ozone (O_3), and nitrogen dioxide (NO_2). Ambient air quality standards must not be exceeded in areas where the general public has access.

The CAA established two types of NAAQS:

Primary standards: Primary standards set limits to protect public health, including the health of "sensitive" populations (such as asthmatics, children, and the elderly).

Secondary standards: Secondary standards set limits to protect public welfare, including protection against decreased visibility, and damage to animals, crops, vegetation, and buildings.

The EPA regularly reviews the NAAQS (every five years) to ensure that the latest science on health effects, risk assessment, and observable data such as hospital admissions are evaluated, and can revise NAAQS if the data supports a revision. The Colorado Air Pollution Control Commission can establish state ambient air quality standards for any criteria pollutant, and those standards must be at least as stringent as the federal standards. Table 3-1 lists the federal and Colorado ambient air quality standards.

Table 3-1. National and Colorado Ambient Air Quality Standards

Pollutant [final rule citation]		Standard Type	Averaging Period	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		Primary	8-hour	9 ppm[a]	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		Primary and secondary	Rolling 3-month average	0.15 $\mu g/m^3$	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		Primary and secondary	Annual	53 ppb	Annual mean
Ozone [73 FR 16436, Mar 27, 2008]		Primary and secondary	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particulate Matter [73 FR 3086, Jan 15, 2013]	$PM_{2.5}$	Primary	Annual	12 $\mu g/m^3$	Annual mean, averaged over 3 years
		Secondary	Annual	15 $\mu g/m^3$	Annual mean, averaged over 3 years
		Primary and secondary	24-hour	35 $\mu g/m^3$	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24-hour	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm[b]	Not to be exceeded more than once per year

Source: National – 40 CFR 50, Colorado – 5 CCR 1001-14.

[a] mg/m^3 = milligrams per cubic meter, $\mu g/m^3$ = micrograms per cubic meter, ppb = parts per billion, ppm = parts per million.
[b] Colorado Ambient Air Quality Standard for 3-hour SO_2 is 0.267 ppm.

For areas that do not meet the NAAQS (these are designated by EPA as nonattainment areas), the CAA establishes timetables for each region to achieve attainment of the NAAQS. The State (Colorado Department of Public Health and Environment [CDPHE]) must prepare a State Implementation Plan (SIP), which documents how the region would reach attainment by the required date. A SIP includes inventories of emissions within the area and establishes emission budgets (targets) and emission control programs that are designed to bring the area into compliance with the NAAQS. In maintenance areas (former nonattainment areas that have achieved attainment), SIPs document how the State intends to maintain compliance with NAAQS.

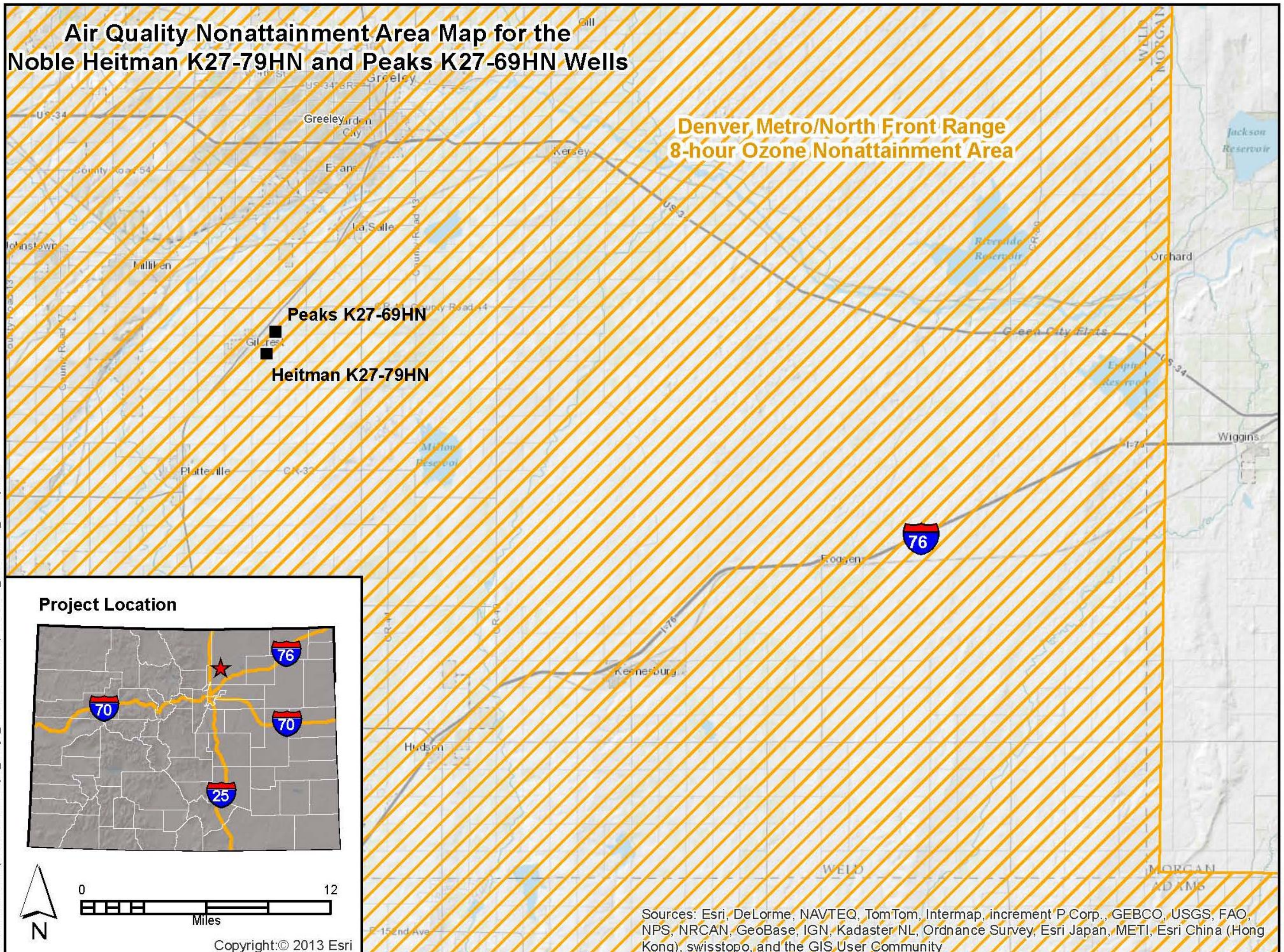
The CAA and the Federal Land Policy and Management Act of 1976 (FLPMA) require the BLM and other federal agencies to ensure actions taken by the agency comply with federal, state, tribal, and local air quality standards and regulations. FLPMA further directs the Secretary of the Interior to take any action necessary to prevent unnecessary or undue degradation of the lands [Section 302 (b)], and to manage the public lands "in a manner that would protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values" [Section 102 (a)(8)].

Section 176(c) of the CAA prohibits Federal entities from taking actions in nonattainment or maintenance areas that do not "conform" to the SIP. The purpose of this conformity requirement is to ensure that Federal activities: (1) do not interfere with the budgets in the SIPs; (2) do not cause or contribute to new violations of the NAAQS; and (3) do not impede the ability to attain or maintain the NAAQS. To implement

CAA Section 176(c), EPA issued the General Conformity Rule (40 CFR Part 93, Subpart B), which applies to all Federal actions not funded under U.S.C. Title 23 or the Federal Transit Act. (BLM actions are not funded by U.S.C. Title 23 or the Federal Transit Act.) The General Conformity Rule established emissions thresholds (40 CFR 93.153), known as *de minimis* levels, for use in evaluating the conformity of a project. If the net emissions increases due to the project are less than these thresholds, the project is presumed to conform and no further conformity evaluation is required. If the emissions increases exceed any of these thresholds, a conformity determination is required. The conformity determination can entail air quality modeling studies, consultation with the EPA and state air quality agencies, and commitments to revise the SIP or to implement measures to mitigate air quality impacts. The BLM, as the federal entity with jurisdiction for the Proposed Action, must demonstrate that the Proposed Action meets the requirements of the General Conformity Rule.

The Project Area is located within the EPA-designated Denver-Boulder-Greeley-Fort Collins ozone nonattainment area, managed under the Denver region ozone SIP. Accordingly, the proposed wells are subject to the conformity requirements. Figure 3-1 depicts the well site locations with respect to the nonattainment area.

Figure 3-1. Well Locations and Ozone Nonattainment Area



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Source: ESRI 2013, Enivonmental Protection Agency 2008

The Prevention of Significant Deterioration (PSD) provision of the CAA established Class I areas in which very little degradation of air quality is allowed (e.g., national parks and large wilderness areas) and Class II areas which encompass all non-Class I areas. The PSD Class II designation allows for moderate degradation of air quality within certain limits above baseline air quality. The Project Area is designated as a Class II area. The closest Class I area to the proposed well site locations is Rocky Mountain National Park, which lies approximately 40 miles to the west.

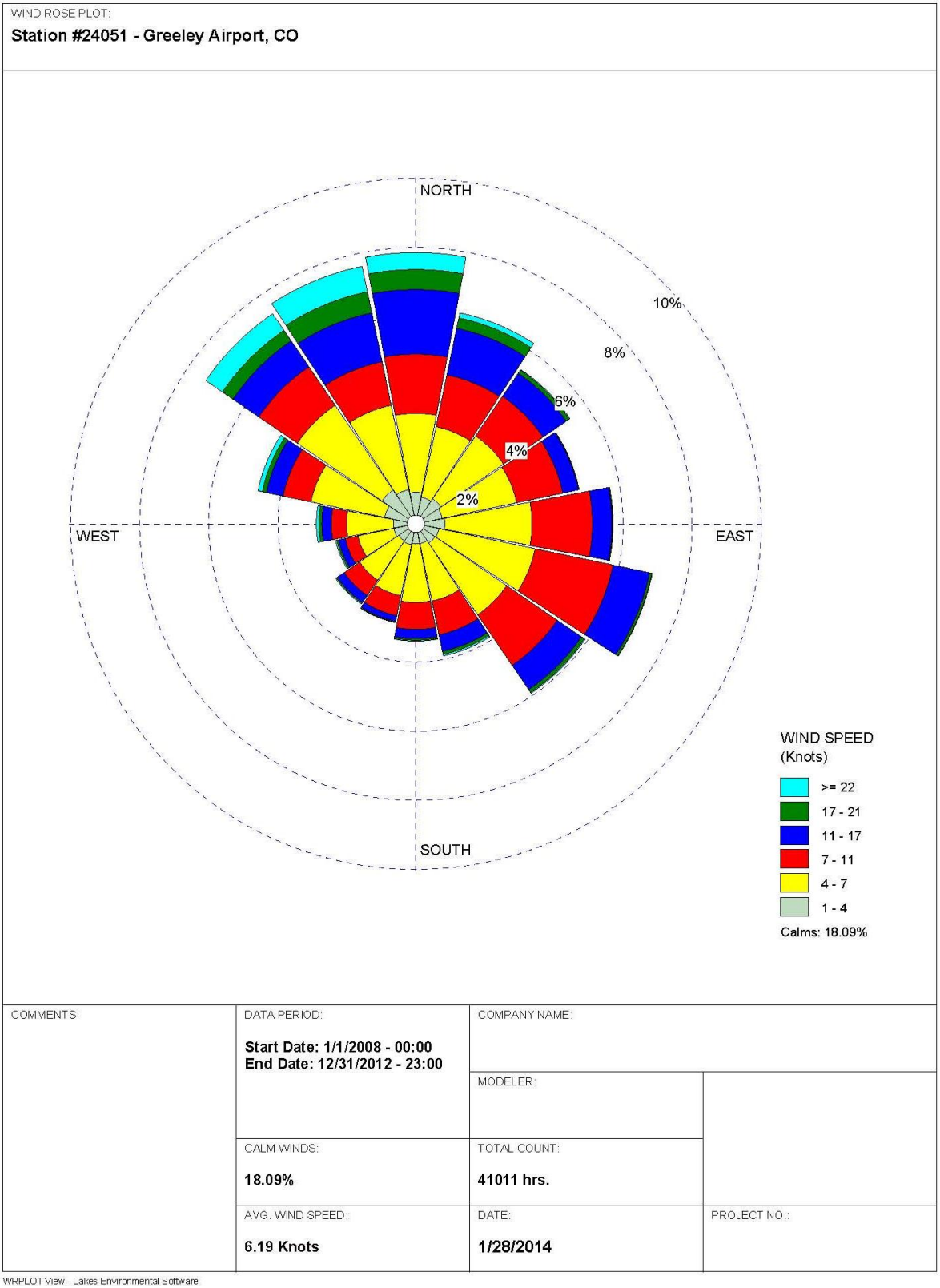
Land Use in the Project Region

The vicinity of the Project Area (southwestern Weld County) is predominantly used for agriculture. The small town of Gilcrest, population 1,034 in 2010 (U.S. Census, 2013a), lies to the west of the Project Area. The population density of Weld County is generally low and dispersed, with 63 people per square mile (U.S. Census, 2013b). Approximately 75% of the available land area of Weld County is linked to the agricultural sector of the economy. Oil and gas development is another major economic driver for the area, and Weld County has some 17,000 active wells within its boundaries (BLM, 2012). Activities occurring within the area that affect air quality include exhaust emissions from motor vehicles, agricultural equipment, drilling rigs and other oil and gas development activities, as well as fugitive dust from roads, agriculture, and energy development (BLM, 2012).

Meteorology in the Project Region

Mean temperatures in the area range from 27.8 degrees Fahrenheit (°F) in January to 74.0° F in July. The area receives average annual precipitation of approximately 14.22 inches (NOAA, 2013). Over the course of the year, typical wind speeds vary from 0 mph to 20 mph. The highest daily average wind speed of 10 mph occurs in April, and the lowest daily average wind speed of 5 mph occurs in August (Weatherspark, 2013). Figure 3-2 presents a wind rose for observations made at Greeley Airport during 2008-2012. Figure 3-2 shows that the predominant wind directions are from the north through northwest and the east through southeast.

Figure 3-2. Wind Rose for Greeley, CO Airport



Existing Air Quality Measured in the Region

The CDPHE Air Pollution Control Division (APCD) measures ambient air quality at a number of locations throughout the state. The nearest APCD air monitors to the Project Area are the Weld County West Annex (measuring CO), County Tower (measuring O_3), and Hospital (measuring PM_{10} and $PM_{2.5}$) stations located in Greeley, as well as one station in Platteville (measuring $PM_{2.5}$), and one station in Welby (measuring NO_2 and SO_2). Table 3-2 provides the measured concentrations of criteria pollutants at these monitoring stations for the most recent three years. There are no lead monitors near the Project Area. Table 3-2 indicates that no violations of the NAAQS have occurred in the project region in the last three years.

Table 3-2. Measured Ambient Concentrations in the Region

Monitor Location	Pollutant (Averaging Period – Unit, Form)	Measured Concentration		
		2010	2011	2012
Weld County West Annex, Greeley	CO (1 Hour - ppm, maximum)	4.2	2.7	3.2
	CO (8 Hour - ppm, maximum)	2.5	2.0	2.3
Weld County Tower, Greeley	O_3 (8 Hour - ppm, 4th maximum)	0.073	0.077	0.080
3174 E. 78th Ave., Welby	NO_2 (1 Hour - ppb, 98th percentile)	56	64	64
	NO_2 (Annual - ppb, annual mean)	16.0	18.1	18.9
Weld County Health Dept. (Hospital), Greeley	PM_{10} (24 Hour - µg/m^3, maximum)	44	46	102
	$PM_{2.5}$ (24 Hour - µg/m^3, 98th percentile)	20	23	32
	$PM_{2.5}$ (Annual - µg/m^3, annual mean)	7.3	6.7	7.9
South Valley Middle School, Platteville	$PM_{2.5}$ (24 Hour - µg/m^3, 98th percentile)	17	20	22
	$PM_{2.5}$ (Annual - µg/m^3, annual mean)	7.6	7.4	7.8
3174 E. 78th Ave., Welby	SO_2 (1 Hour - ppm, 99th percentile)	37	30	28
	SO_2 (3 Hour - ppm, maximum)	0.030	0.024	0.017

Source: EPA 2013a

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

Direct and Indirect Impacts of Criteria Pollutants: The Proposed Action would have a temporary, localized negative impact to air quality during the construction phase. Surface disturbance, utilization of the access road, and construction activities such as drilling, hydraulic fracturing, well completion, and equipment installation would impact air quality through the generation of dust related to earthmoving, travel, transport, and general construction. This phase would also produce short-term emissions of criteria pollutants, hazardous air pollutants (HAPs), and greenhouse gases (GHGs) from vehicle and construction equipment exhaust. The primary GHGs are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Once construction is complete, the daily activities at the site would be reduced to operational and maintenance checks which may be as frequent as daily visits. Emissions would result from vehicle exhaust from the maintenance and process technician visits, as well as oil and produced water collection or load out trips. The pads can be expected to produce fugitive emissions of well gas and liquid flashing gases, which contain a mixture of methane, volatile organic compounds (VOCs), HAPs, and inert or non-regulated gases. Fugitive emissions are emissions that are not associated with a stack, exhaust vent, or other defined point. Fugitive emissions may result from pressure relief valves and working and breathing losses

from any tanks located at the sites, as well as any flanges, seals, valves, or other infrastructure connections used at the sites. Liquid product load-out operations would also generate fugitive emissions of VOCs.

Ozone is not directly emitted like other criteria pollutants. Ozone is chemically formed in the atmosphere via reactions of ozone precursors, primarily oxides of nitrogen (NOx) and VOCs, in the presence of the ultraviolet component of sunlight. Ozone concentrations are the result of these complex reactions involving VOC and NOx emissions from all sources within a region. Ozone concentrations change over time as these reactions continue while sunlight is present, and additional sources contribute emissions as air is transported across long ranges (as much as hundreds of miles). Therefore, prediction of potential impacts on ozone levels from individual projects like the Proposed Action is impractical, and potential ozone impacts are evaluated based on the project's emissions of VOCs and NOx.

Emissions from construction and operation (production) of the proposed wells were estimated by the applicant and are provided in Table 3-3 below. The following pollutants were inventoried where an appropriate basis, methodology, and sufficient data exists: CO, NOx (includes NO_2), $PM_{2.5}$, PM_{10}, SO_2, VOCs, HAPs, CO_2, CH_4, and N_2O. The emissions estimates were developed using reasonable scenarios for each activity. Annual production emissions were calculated based on full production activity for the entire year. Potential emissions were calculated for each well assuming the legally required control measures, operational parameters, and equipment configurations data that were provided by the applicant. Construction of pipelines and electric lines, traffic on paved roads, workovers/restimulation, and reclamation were not included in the emissions calculations because these activities are likely to contribute only a small proportion of the total emissions.

The following assumptions were used in estimating project emissions. These assumptions are more conservative than the detail in the Proposed Action and likely result in greater estimated impacts than would actually occur:

- The disturbed surface area per well pad was assumed to be 8 acres.
- Construction was assumed to occur for 14 work days per well.
- An access road 1 mile long and 25 feet wide was assumed to be constructed for each pad.
- All disturbed surfaces (pads, access roads and production facilities) would receive appropriate application of water during construction and dust palliatives during operations. The dust control effectiveness was assumed to be 50 percent.
- Drilling was assumed to occur for 10 days per well.
- Drill rig engines would meet EPA Non-road Tier 2 emissions standards.
- All diesel fuel would be standard transportation grade (500 ppm sulfur).
- The well pad equipment would include tanks, separation equipment, and well head compression, but no dehydration or desulfurization units.
- The applicant would perform 'Green Completions' for all wells.
- Condensate was estimated at 50,000 barrels per year per well, and produced water at 30,000 barrels per year per well.
- Flowback would not be vented. Fugitive well emissions would be controlled by flaring as necessary.
- The production lifetime of the project was assumed to be 20 years.

For further details on the emissions calculations see Appendix A.

Table 3-3. Estimated Emissions from the Proposed Action

Description	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_x	CO_2	CH_4	N_2O
One-Time Emissions (tons[a])									
Construction	0.72	0.20	0.0699	1.02	0.16	0.079	106	0.0011	0.0014
Rig Move & Drilling	3.18	3.31	0.38	0.45	0.036	9.1×10^{-4}	1,740	0.0061	0.0064
Completion	0.24	0.48	0.169	0.27	0.027	1.6×10^{-4}	254	0.0027	4.9×10^{-4}
Total One-Time Emissions	4.14	4.00	0.62	1.74	0.22	0.080	2,100	0.010	0.0083
Annual Emissions (tons/year)									
Production[b]	2.16	4.08	11.93	1.57	0.157	6.8×10^{-4}	2,140	0.191	0.0043
Annual Emissions per Well Compared to CDPHE Modeling Guideline Thresholds (tons/year)									
Production[b] (per well)	1.89	3.66	6.49	0.78	0.078	3.4×10^{-4}	1,920	0.104	0.008
CDPHE Thresholds (CDPHE 2011)	40	100	No threshold	15	5	40	No threshold	No threshold	No threshold
Total One-Time GHG Emissions plus Life-of-Well (20 years) GHG Emissions									
GHGs (tons)							44,892	3.83	0.09
Total CO_2e[c] emissions (metric tons)									40,824

Source: Noble Energy, 2013.

Note: Sum of individual values may not equal summary value due to rounding.

[a] Short tons (1 ton = 2,000 lb) unless metric tons are specified.
[b] Production emissions from all wells are less than the single well total times the number of wells because there is only one compressor engine, which serves the output of all wells connected to the production facility. The engine exhaust emissions are included in the total.
[c] CO_2e = CO_2 equivalent, based on 100-year Global Warming Potentials of CO_2 = 1, CH_4 = 21, and N_2O = 298 (Forster *et al.* 2007).

Air quality impacts in the near-field area were assessed in terms of potential pollutant concentrations that could result from the Proposed Action emissions. The near field is the area within a radius of approximately 1 kilometer (0.621 mile or 3,281 feet) from the well pad (BLM, 2012a). As shown in Figure 2-1 of this EA, the proposed wells are distributed spatially (approximately 1.05 miles or 1.7 kilometers apart) such that near-field air quality impacts due to one well are not likely to contribute substantially to pollutant concentrations in the near-field area associated with another proposed well (BLM 2013). For this reason, it is reasonable to address near-field concerns for each proposed well separately.

Potential near-field impacts of criteria pollutants with respect to the NAAQS were evaluated based on CDPHE modeling guidelines (CDPHE 2011). As shown in Table 3-3, the emissions estimates for an individual well are less than the modeling guideline thresholds, and therefore are below the level at which CDPHE would require air quality modeling for minor sources. Under the modeling guidelines CDPHE considers emissions below the thresholds to have little or no potential to cause a violation of the NAAQS. For these reasons, near-field air quality modeling of criteria pollutants was not conducted for the proposed oil and gas development and operations.

Table 3-4 below compares the project emissions to total Weld County emissions as inventoried by the CDPHE for 2010 (the most recent year available). It also shows Weld County's oil and gas area and point source emissions for the same period. (Point sources are larger individual sources that have a definable stack or other emission point. Area sources are smaller sources that are inventoried in aggregate by CDPHE.)

Table 3-4. Comparison of Proposed Action and Weld County Emissions

Pollutant	Emissions (tons per year)				
	Proposed Action Wells (Production)	Proposed Action Wells, as Percent of Total Weld County Emissions	Weld County Total (2010)	Weld County Oil & Gas Area Sources (included in county total)	Weld County, Oil & Gas Point Sources (included in county total)
NOx	2.16	0.0071%	30,365	9,514	5,503
CO	4.08	0.0045%	91,338	6,088	5,155
VOC	11.93	0.0088%	135,941	37,762	65,035
PM_{10}	1.57	0.0052%	29,948	460	134
$PM_{2.5}$	0.16	ND	ND	ND	ND
SOx	6.8×10^{-4}	1.2×10^{-4} %	545	70	43
HAPs	0.027	0.0076%	354	ND	151

Source for Weld County emissions: CDPHE 2013. ND = No Data. CDPHE HAP inventory and proposed action HAPs are for benzene only.

The project emissions are relatively small compared to the Weld County emissions: 0.0088 percent or less for each pollutant. The project one-time and annual emission levels and their small percentage of Weld County emissions indicate that the Proposed Action is unlikely to cause or contribute to an exceedance of an ambient air quality standard.

Direct and Indirect Impacts of HAPs:

The CDPHE modeling guidelines do not provide thresholds for evaluation of HAP emissions and concentrations, nor have NAAQS been established for HAPs. Although the land around the Proposed Action wells is largely in agricultural use, some residences are located within the near-field area. The nearest residence to the Peaks 27 well is located approximately 610 feet from the well, and the nearest residence to the Heitman 27 well located approximately 580 feet away. The nearest residence to the production facility is located approximately 560 feet away (measured from the tank pad; the tanks are the nearest equipment that could produce emissions). Because of the proximity of the production facility to these residences, potential HAP impacts at the residences were assessed using a near-field dispersion modeling assessment. For modeling purposes, emissions from the production facility were estimated based on the output of five wells – the proposed action plus three other potential wells – in order to provide an indication of cumulative as well as direct and indirect impacts. The modeling assessment showed that maximum short-term (1 hour) HAP concentrations would be much less than the applicable Reference Exposure Levels (EPA 2011). Potential cancer risk from long-term (annual) HAP exposure was estimated using Reference Concentrations expressed as unit risk factors (EPA 2012). The maximum potential cancer risk for all HAPs modeled, for a Maximally Exposed Individual scenario, was approximately 20 in one million. Most of the modeled risk level was due to the assumed background HAP concentrations and not the Proposed Action. See Appendix B for details of the modeling assessment and results.

General Conformity Evaluation: As noted above, under the General Conformity Rule, the portion of project emissions that occurs in a nonattainment or maintenance area must be compared to the applicable thresholds. Because the Project Area is designated as nonattainment for ozone, the applicable thresholds are for the ozone precursors NOx and VOC. Table 3-5 provides the estimated NOx and VOC emissions for the project and compares them to the conformity thresholds. The table provides emissions

estimates for a worst-case year, corresponding to a hypothetical scenario in which well construction, drilling, and completion occur at the beginning of a year, followed by one year of production. The production emissions in Table 3-5 exclude emissions from sources that are anticipated to require air quality (new source review) permits from the CDPHE because emissions permitted under new source review are exempt from the conformity requirements. Table 3-5 shows that the emissions are less than the conformity thresholds for a worst-case year. Even if emissions permitted under new source review are included, the total emissions would remain less than the thresholds. Accordingly, the project conforms to the Denver region ozone SIP.

Table 3-5. NOx and VOC Emissions and Conformity Evaluation

Description	NO_x	VOC
One-Time Emissions (tons)		
Construction	0.72	0.07
Rig Move & Drilling	3.18	0.38
Completion	0.24	0.17
Total One-Time Emissions	4.14	0.62
Annual Emissions (tons/year)		
Production[a]	3.71	4.24
Worst-Case Year: Total One-Time Emissions Plus One Year of Production Emissions (tons)	7.85	4.87
General Conformity threshold (40 CFR 93.153) (tons/year)	100	100

Source: Noble Energy, 2013

Note: sum of individual values may not equal summary value due to rounding.

[a] Does not include emission sources that are subject to CDPHE air quality (new source review) permits and are exempt from conformity requirements. The estimated emissions anticipated to be subject to new source review permitting are 0.08 tons per year of NO_x and 8.50 tons per year of VOCs.

Greenhouse Gas Emissions and Climate Change: According to the U.S. Global Change Research Program (2009), global warming is unequivocal, and the global warming that has occurred over the past 50 years is primarily human-caused. Specific thresholds of significance for GHG emissions have not been established by regulatory agencies. Predicting the degree of impact any single emitter of GHGs may have on global climate, or on the changes to biotic and abiotic systems that accompany climate change, is highly complex, has considerable uncertainty, and requires substantial computer modeling resources. This analysis is therefore limited to presenting project GHG emissions in context through comparisons to Colorado and national GHG emissions. The GHG emissions from the Proposed Action do not account for the ultimate use or consumption of any products generated by the project (i.e., life cycle GHG analysis) because any additional processing and ultimate uses for the products is unknown. Section 3.5, Cumulative Impacts, provides a summary of information regarding expected changes to the global climatic system and empirical evidence of climate change that has occurred to date.

Table 3-6 compares the Proposed Action GHG emissions to Colorado and national emissions. Table 3-6 shows that the GHG contribution associated with the Proposed Action is extremely small in this context.

Table 3-6. Greenhouse Gas Emission Comparisons

Inventory Description	CO_2e Emissions (10^6 metric tons per year)	Proposed Action Percentage
Proposed Action (one-time emissions plus one year of production emissions)	0.0039	–
Colorado GHGs (2010)[a]	105	0.0051%
Total U.S. GHGs (2011)[b]	5,797	9.3×10^{-5}%

[a] Source: CDPHE 2007.
[b] Source: EPA 2013b.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action Alternative, the BLM would not authorize any of the Proposed Action elements. However, because the project sites are privately owned surface, the same well construction and operation could occur as under the Proposed Action, provided that the wells were drilled to stop short of draining federally-owned oil and gas. Consequently, the air quality and GHG impacts described above for the Proposed Action could occur, except that drilling emissions under the No Action Alternative might be slightly less if avoidance of federally-owned oil and gas necessitates shorter well shafts. As a result, the air quality impacts associated with No Action Alternative would be essentially the same as those disclosed under the Proposed Action.

Protective/Mitigation Measures

The applicant would comply with Colorado Oil and Gas Commission (COGCC) Rule 805 which requires control of VOC emissions, odors, and fugitive dust. Noble would use industry best practices, including watering, graveling, and reseeding (or re-planting) to reduce fugitive dust emissions from vehicular traffic and disturbed surfaces. Interim reclamation and existing agricultural practices would be implemented in order to stabilize the site and prevent fugitive dust from being generated. In addition, the following BLM requirements would apply:

- Process equipment would be permitted by CDPHE in accordance with applicable requirements and required emissions standards to limit the facility's potential to emit and provide appropriate operating, monitoring, and recordkeeping requirements.
- VOC emissions from storage tanks would be controlled using control technology that would reduce VOC emissions by at least 95 percent relative to uncontrolled conditions.
- The operator would control fugitive emissions of particulate matter (dust) during construction and production, using procedures and control technology that would reduce dust emissions by at least 50 percent relative to uncontrolled conditions.
- All pump engines would be required to meet EPA Non-Road Tier II emissions standards.
- All drill rig engines would be required to meet EPA Non-Road Tier II emissions standards.
- The operator would perform 'Green Completions' for all wells, as required by COGCC Rule 805.b(3).
- All continuous-bleed devices would operate at "low-bleed" rates. If a "high-bleed" device is needed Noble would obtain approval from the CDPHE Air Pollution Control Division in accordance with CDPHE Regulation 7.XVIII.C.3 (5 CCR 1001-9).

- Noble would take every possible precaution to minimize uncontrolled gas venting associated with well blowdowns or maintenance activities.

The BLM would include these requirements as COA's for each of the APDs. The BLM expects that the operator would comply with these requirements and make every effort to minimize emissions through good engineering and operating practices to the maximum extent practical. These requirements would help minimize the project's air quality impacts in the Denver/North Front Range ozone nonattainment area, and reduce the HAP concentration levels in the Project area.

3.2.2 Geologic and Mineral Resources

Affected Environment

The proposed wells and production facilities are located within the Wattenberg gas field in the Denver Basin, where the primary target is the Codell/Niobrara oil and gas. Most oil and gas in the Denver Basin has been produced from Cretaceous sandstones: J-Sandstone, Codell Sandstone, Niobrara Formation, Hygiene Sandstone, and Terry Sandstone (also known informally as the Sussex and Shannon Sandstones). The Project Area is surrounded by privately owned producing gas wells on a Colorado state spacing order of 20 acres per well. According to COGCC data, there are 69 oil and gas wells within a one-mile radius of the Peaks K27-69-HN well surface location and 72 oil and gas wells within a one-mile radius of the proposed bottom hole location. The same source also indicated that there are 65 oil and gas wells within a one-mile radius of the Heitman K27-79HN well surface location and 74 oil and gas wells within a one-mile radius of the proposed bottom hole location (2014). Because of the proximity of the proposed well sites, many of the same wells occur within the one-mile radius.

Groundwater resources in the area include the Arapahoe and the Laramie-Fox Hills aquifers, separated by the Laramie Formation. The Laramie-Fox Hills aquifer underlies approximately 6,700 square miles and marks the areal extent of the basin for economic ground water development. The Laramie-Fox Hills aquifer is 250 to 300 feet thick and includes about 150 to 200 feet of fine-grained and medium-grained sandstone. Water is also present in the Upper Pierre Shale at depths of up to 1,500 feet. Water from the aquifer is used extensively throughout the area for domestic and agricultural purposes; however, it typically yields water in quantities sufficient for commercial development. Well yields can be as high as 100 gallons per minute (gpm), but they are generally lower. The Laramie Formation forms the hydraulic barrier that separates the Arapahoe aquifer from the Laramie-Fox Hills aquifer (Pottorff, 2012).

The Arapahoe aquifer underlies an area of almost 4,700 square miles and is generally about 400 feet thick. The northern portion of the hydrogeological unit can be subdivided into an upper and lower aquifer that is separated by shale ranging from 50 to 100 feet thick. High capacity wells (300+gpm) are common in the Arapahoe aquifer, which is used extensively to supply municipal water systems (Pottorff, 2012). Both the Laramie-Fox Hills and Arapahoe aquifers are under artesian pressure at the present time.

In addition to oil and gas, uranium and coal resources are also found in Weld County. Uranium resources are found in the Upper Laramie Formation north of Greeley. Coal resources are found throughout the Denver Basin in the Denver Formation and the upper Laramie Formation in the Denver Basin, although most of the coal resources in the Denver Basin have come from Laramie Coals Formation. Sand and gravel resources are also located throughout Weld County; several sand and gravel pits have also been developed within 10 miles of the Project Area.

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

The Proposed Action would drill through the Arapahoe and Laramie-Fox Hills aquifers to produce hydrocarbons from underlying formations. During drilling operations on parcels, loss of circulation or problems cementing the surface casing could directly affect freshwater aquifer and mineral zones encountered. Known water-bearing zones in the Project Area would be protected by drilling requirements and protective/mitigation measures outlined below. With proper practices, contamination of other mineral zones and ground water resources is highly unlikely.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action Alternative, the APDs would be denied, and no federal action would occur. Not approving the APDs could result in a situation in which reservoirs are not adequately developed, and federal minerals could be drained by nearby private or state wells. The applicant could explore and develop the private land and private minerals and not access the federal minerals. Drainage cases commonly occur in northeastern Colorado, where land and mineral ownership patterns are complex.

Protective/Mitigation Measures

Onshore Order #2, established by the BLM pursuant to various Federal and Indian mineral leasing statutes and the Federal Oil and Gas Royalty Management Act of 1982, requires that the proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones. At this stage, geologic and engineering reviews have been done to ensure that cementing and casing programs are adequate to protect all downhole resources. Known water bearing zones in the Project Area are protected by drilling requirements and, with proper practices, contamination of ground water resources is highly unlikely (see Water Resources). Casing along with cement would be extended well beyond fresh-water zones to insure that drilling fluids remain within the well bore and do not enter groundwater.

3.2.3 Soils

Affected Environment

Slopes in the Project Area range from 0-3 percent, which means erosion potential is low to moderate.

Using Natural Resources Conservation Service (NRCS) data, two major soil types have been identified in the Project Area.

Bresser sandy loam, 0 to 1 percent slopes. The Bresser fine sandy loam is a well-drained, linear (0% to 1% slopes) soil found on terraces with elevations ranging from 4,700 to 4,800 feet. This soil is formed in alluvium derived from sandstone and shale. The permeability is moderately rapid, runoff is slow to medium and erosion hazard is slight to moderate. This soil is generally used for farmland (if irrigated), grazing and wildlife habitat. The mean annual precipitation is 12 to 15 inches and the mean annual temperature is about (46 to 52°F).

Julesburg sandy loam, 0 to 1 percent slopes. The Julesburg sandy loam is a well-drained, linear (0% to 1% slopes) soil found on terraces with elevations ranging from 4,700 to 4,800 feet. This soil is formed in alluvium derived from sandstone and shale. The permeability is rapid, runoff is slow and erosion hazard is slight. This soil is generally used for farmland (if irrigated), grazing and wildlife habitat. The mean annual precipitation is 15 to 19 inches and the mean annual temperature is about (48 to 52°F).

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

Surface disturbance from new well pads, access roads, production facilities, and pipelines would result in the initial temporary disturbance of soils and vegetation on up to 22 acres. Well pad construction (for both wells) would require a total of approximately 26,100 cubic yards of top soil removal and stockpiling. The amount of long-term disturbance would be less than seven acres total for the two pads, two production facilities, pipelines, and access roads following successful interim reclamation including re-contouring and seeding or re-planting with crops. All areas of disturbance associated with pipelines would be fully reclaimed. Indirectly, the increased runoff from the disturbed soils could result in increased erosion and gullying down-gradient. Due to the near level topography within the Project Area, and the construction standards being proposed, the impacts to soils off-site would be minimal.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action Alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts to soils would be the same as those described for the Proposed Action.

Protective/Mitigation Measures

Noble has committed to building all infrastructure (road, drill pads, etc.) to BLM Gold Book standards on these private surface wells. If the proposed project plans to utilize federal minerals in the construction of roads, well pads, or for any other construction needs, then compliance with 43 CFR 3600 is required. The proponent would need to submit an application for mineral materials disposal with the BLM, prior to any disturbance being initiated. Federal mineral materials regulations also apply to split estate (i.e., a private surface landowner could not dispose of federal mineral materials for this project, surface or subsurface, without prior authorization from the BLM).

3.2.4 Water (Surface and Groundwater, Floodplains)

Affected Environment

The proposed wells are located on cultivated cropland. The area is tributary to the South Platte River (Hydrologic Unit Code 10190012). The South Platte River is the nearest perennial water body, which is located more than three miles north of the proposed wells. Several ditches, which are tributary to the South Platte River, are located less than one mile from the proposed well pads. Groundwater in this area consists of the Laramie Fox-Hills aquifer and the Arapahoe aquifer. The Laramie Fox-Hills aquifer is used for domestic and agricultural purposes and is generally produced from artesian wells. This aquifer can be up to 350 feet thick, although total thickness of water yielding material rarely exceeds 200 feet. The Arapahoe aquifer is located above the Laramie-Fox Hills aquifer and is the most permeable and heavily used aquifer within the region. The Arapahoe aquifer is 400 to 700 feet thick and is mainly used for municipal purposes. The Lower Fox Hills, the upper Pierre Aquifer, and the upper transition zone of the Pierre shale are also important water resources; this interval occurs at depths of about 600 to 1,500 feet. Underlying the Fox Hills aquifer is nearly 5,000 feet of Pierre Shale. There are 194 water wells within a one mile radius of the proposed wells. The deepest water well in this area is 300 feet. There are 88 wells that exist within a one mile radius of the surface hole location of the Peaks K27-69-HN and 106 wells that exist within a one mile radius of the surface hole location of the Heitman K27-79HN (CDWR, 2014).

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

As stated previously, the Proposed Action would drill through the Laramie-Fox Hills aquifer to produce hydrocarbons from underlying formations. During drilling operations on the parcels, loss of circulation or problems cementing the surface casing may affect freshwater aquifer and mineral zones encountered.

Due to the flat nature of the topography, infiltration rates of the soils in this area, and distance from nearby surface waters, impacts to surface water quality would be minimal from construction of roads, well pads, production facilities and drilling the proposed wells. For these same reasons, impacts to surface waters from chemicals or other hazardous substances accidentally spilled or leaked during the development process would also be minimal.

Drilling the proposed wells would pass through usable groundwater. Groundwater in this area is relied on for agricultural and domestic use. Potential impacts to groundwater resources could occur if proper cementing and casing programs are not followed. This could include loss of well integrity, surface spills, or loss of fluids in the drilling and completion process. Chemical additives used in drilling activities can be introduced into the water producing formations without proper casing and cementing of the wellbore. A closed loop drilling mud system would prevent any shallow groundwater contamination.

Geologic and engineering reviews have been done to ensure that cementing and casing programs are adequate to protect all downhole resources. Known water bearing zones in the Project Area are protected by drilling requirements and, with proper practices, contamination of ground water resources is highly unlikely. Casing, along with cement, would be extended beyond fresh-water zones to ensure that drilling fluids remain within the well bore. Compliance with the drilling and completion plans and Onshore Oil and Gas Orders Nos. 2 and 7 would also help avoid adverse impacts on groundwater.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts to water resources would be similar to those described for the Proposed Action depending on the depth of the federal minerals avoided.

Protective/Mitigation Measures

No additional mitigation is required to protect water resources.

3.3 Biological Resources

3.3.1 Vegetation

Affected Environment

The project is located within the High Plains of the Great Plains Physiographic Province. The proposed pads and facilities are located on the east slope of the range in an area with little vegetation. The elevations for the Peaks K27-69-HN and Heitman K27-79HN wells are 4,735 and 4,759 feet above mean sea level, respectively. The dominant vegetation community type around the Project Area is shortgrass prairie, which is primarily dominated by blue grama and buffalo grass; however, the Project Area itself is

cultivated crop land with existing oil and gas development (previously disturbed areas) with little to no native vegetation remaining.

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

Surface disturbance from new and expanded well pads and production facilities would result in the initial disturbance of soils and vegetation on up to 22 acres, and the potential for invasive and noxious weed establishment or expansion. Over the long term, the two well pads and associated production facilities, pipelines, and access roads would be reclaimed to less than seven acres according to interim reclamation plans submitted with the APDs. Much of these reclaimed areas would be revegetated with crops.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action Alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts to vegetation and invasive plant species would be the same as under the Proposed Action alternative.

Protective/Mitigation Measures

No protective or mitigation measures are recommended due to the lack of environmental effects to native or sensitive vegetation.

3.3.2 Invasive Plants

Affected Environment

The dominant vegetation community type around the Project Area is shortgrass prairie, which has been converted to cultivated cropland at the proposed well pad and production facility sites. Colorado maintains a list of noxious weeds, which is posted on the NRCS website. No state-listed noxious weeds or invasive/exotic plant infestations (Class A and B) are known to be present within the Project Area, and the crop land surrounding the Project Area is maintained weed-free. Existing well pads in the vicinity are treated for weeds, as necessary.

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

Surface disturbance from new well pads and new and expanded production facilities would result in the initial disturbance of soils and vegetation on up to 20 acres, potentially increasing the potential for invasive and noxious weed establishment or expansion. Invasive plant species may be introduced as a result of natural dispersal, or from various land-disturbing activities in the surrounding area. Increases in the numbers or extent of invasive plant species would be restricted by control measures proposed in the interim reclamation plan. Well pads are proposed in cultivated crop areas where weeds would be managed by the private landowners.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts to invasive plant species would be the same as under the Proposed Action.

Protective/Mitigation Measures

Best Management Practices (BMPs) for weed control include annual monitoring during and after construction and would likely be required by the private landowners. Noxious weed control guidance is also available from the Weld County Public Works Department. To minimize the spread of noxious weeds, construction crews will wash equipment prior to entering the project area to remove any plant materials, soil, or grease.

3.3.3 Terrestrial Wildlife

Affected Environment

The shortgrass prairies of eastern Colorado are often used for agricultural purposes, including grazing and crop cultivation. In the past, they have supported an array of wildlife species including black-tailed prairie dog, American bison, elk, deer, and Pronghorn. Livestock production continues throughout much of the region where nonrenewable resource development and production is occurring. The private lands on which the two wells are proposed are used for cultivating crops and oil and gas development supported by various infrastructure, including roads and well pads. Wildlife in the area is limited to species that have adapted to the increased development activity in the area; these include pronghorn, small mammals, mesocarnivores, raptors, and herpetofauna. The Project Area is not located in any CDOW-designated summer or winter range or wildlife corridors (CPW 2013).

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

The Proposed Action would initially result in conversion of approximately 22 acres of cultivated cropland, which has been previously disturbed for oil and gas development, to well pads and production facilities. The majority of these areas would be reclaimed and revegetated, likely with crops, with less than seven acres of permanent surface disturbance associated with the two pads, two production facilities, pipelines, and their access roads. There would be a minor direct loss of suitable wildlife habitat in the area. Indirect impacts to wildlife could result from the increase in human activity during the drilling phase, causing an increase in stress to wildlife or limiting movement throughout the project area. Decreased human activity during the production phase would reduce these potential indirect impacts to wildlife as well.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts to terrestrial wildlife would be the same as under the Proposed Action alternative.

Protective/Mitigation Measures

No protective or mitigation measures are recommended due to the lack of environmental effects to terrestrial wildlife.

3.3.4 Migratory Birds

The Migratory Bird Treaty Act (MBTA) includes guidance for the protection of native passerines (songbirds) as well as birds of prey, migratory waterbirds (waterfowl, wading birds, and shorebirds), and other species such as doves, hummingbirds, swifts, and woodpeckers. Within the context of the MBTA, "migratory" birds include non-migratory "resident" species as well as true migrants, essentially encompassing most native bird species. The nesting time period is of special importance as the ability to create a nest, incubate, and rear chicks to fledging is a vulnerable time period for birds, and disturbances to nesting activities can lead to larger consequences for individual birds. In addition, because birds are generally territorial during the nesting season, their ability to access and utilize sufficient food is limited by the quality and availability of the territory occupied. During non-breeding seasons, birds are generally non-territorial and able to feed across a larger area and wider range of habitats.

Affected Environment

The Project Area is located in the shortgrass prairie ecosystem, on private fields used primarily for cultivating crops and oil and gas production. The following species are on the U.S. Fish and Wildlife Services "Birds of Conservation Concern-2008 List" for BCR-18 (Shortgrass Prairie) and might occur in the Project Area based on their habitat requirements: ferruginous hawks, prairie falcons, mountain plovers, upland sandpiper, Sprague's pipit, lark buntings, and Cassin's sparrow.

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

The Project Area and vicinity are already disturbed by agricultural practices and oil and gas development. Some birds have adapted to, and currently use, habitat patches within well fields for reproduction and growth. Based on the protective/mitigation measures outlined below, no vegetation clearing would be allowed between May 15 and July 15 to avoid and minimize impacts to these birds. Surface disturbing activities associated with implementation of the Proposed Action would likely occur during the winter months, which is outside nesting season for these birds. Noise generated during construction, drilling, and production phases would indirect impacts to birds, potentially resulting in avoidance of the Project Area; however, there is sufficient habitat in surrounding areas to absorb this indirect loss of habitat. Based on the proposed construction times and protective mitigation measures below, the Proposed Action is not anticipated to impact migratory birds or their nests.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts to migratory birds would be the same as described for the Proposed Action.

Protective/Mitigation Measures

To be in compliance with the Migratory Bird Treaty Act (MBTA) and the Memorandum of Understanding between the BLM and USFWS required by Executive Order 13186, the BLM must avoid actions, where possible, that result in a "take" of migratory birds. Under the MBTA, "take" means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct. All mortality or injury to species protected by the MBTA shall be reported immediately to the BLM project lead and to the USFWS representative.

Pursuant to BLM Instruction Memorandum 2008-050, to reduce impacts to Birds of Conservation Concern (BCC), no habitat disturbance (removal of vegetation such as timber, brush, or grass) is allowed during the periods of May 15 - July 15, during the breeding and brood rearing season for most Colorado migratory birds. An exception to this timing limitation (TL) would be granted if nesting surveys conducted no more than one week prior to surface-disturbing activities indicate no nesting within 30 meters (100 feet) of the area to be disturbed. Surveys shall be conducted by a qualified breeding bird surveyor between sunrise and 10:00 a.m. under favorable conditions. This provision does not apply to ongoing construction, drilling, or completion activities that are initiated prior to May 15 and continue into the 60-day period.

Any secondary containment system would be covered in a manner to prevent access by migratory birds. The operator would construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, and in-line units. Any action that may result in a "take" of individual migratory birds or nests that are protected by MBTA would not be allowed.

3.3.5 Threatened, Endangered, and BLM Sensitive Species

Affected Environment

The U.S. Fish and Wildlife Service (USFWS) lists threatened, endangered, and candidate species per the Endangered Species Act (ESA). The USFWS periodically posts a list of species having threatened (T), endangered (E), and candidate (C) status and with the potential to occur in the area. The USFWS 2012 list for Weld County includes Mexican spotted owl (T), piping plover (T), least tern (E), black-footed ferret (E), Preble's meadow jumping mouse(T), Ute ladies'-tresses orchid (T), and Colorado butterfly plant (T). There are no candidate species listed for Weld County.

Suitable habitat does not exist for the threatened and endangered species with the potential to occur in the Project Area. There is no suitable habitat in the Project Area for Mexican spotted owl, which resides in old growth or mature forests, nor is there any nearby water to support the piping plover or least tern. There is no suitable habitat for Preble's meadow jumping mouse or the two listed plants, due to the lack of riparian and wetland communities within the Project Area. The USFWS, in coordination with the Colorado Division of Wildlife (CDOW, now known as Colorado Parks and Wildlife [CPW]), has block-cleared all black-tailed prairie dog habitat in eastern Colorado, including Weld County. They have determined that these areas no longer contain any wild free-ranging black-footed ferrets (USFWS 2009).

The BLM Colorado State Director's Sensitive Species List indicates that twenty-one wildlife species have potential to occur in the Royal Gorge Field Office, including six mammals, ten birds, two fish, and three amphibians (BLM 2009). No species surveys were conducted for this project. Although suitable habitat exists within the general area, the Project Area is active cropland with existing oil and gas development.

Environmental Effects

Because there is no suitable habitat within the Project Area, potential effects to threatened, endangered, and BLM sensitive species are not anticipated under the Proposed Action or the No Action Alternative.

Protective/Mitigation Measures

No protective or mitigation measures are recommended due to the lack of environmental effects to threatened, endangered, or BLM sensitive species.

3.4 Heritage Resources and Human Environment

3.4.1 Cultural Resources

Affected Environment

Both prehistoric and historic sites are present in the vicinity of the Areas of Potential Effect (see Reports CR-RG-14-65 N and CR-RG-14-93 N). However, no sites eligible for the NRHP were recorded within the Areas of Potential Effect during the cultural resources inventories.

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

Because no eligible sites were found during the cultural resources inventories, the proposed undertaking will not affect historic properties. Therefore, the proposed action will cause no direct or indirect impacts.

No Action Alternative (Direct and Indirect Impacts)

Same as proposed action.

Protective/Mitigation Measures

None necessary.

3.4.2 Native American Religious Concerns

Affected Environment

Although aboriginal sites are present in Weld County, there are no identified properties of traditional religious or cultural significance in the APEs. The cultural resources inventories of the APEs produced no other evidence that suggests the APEs holds special significance for Native Americans.

The BLM conducted a consultation with the following tribes: Apache Tribe of Oklahoma, Cheyenne and Arapaho Tribes of Oklahoma, Cheyenne River Sioux Tribe, Comanche Tribe of Oklahoma, Crow Creek Sioux, Eastern Shoshone, Jicarilla Apache Nation, Kiowa Tribe of Oklahoma, Northern Arapaho Tribe, Northern Cheyenne Tribe, the Ute Tribe, Oglala Sioux Tribe, Pawnee Tribe, Rosebud Sioux Tribe, Southern Ute Tribe, Standing Rock Lakota Tribe, and the Ute Mountain Ute Tribe.

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

No properties of traditional religious and cultural significance were identified by the tribes; therefore, no direct or indirect impacts to properties of concern to the tribes are anticipated with implementation of the Proposed Action.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts to properties of traditional

religious and cultural significance would be the same as described for the Proposed Action. If the undertakings did not occur, there would be no direct or indirect effects on properties of traditional religious and cultural significance.

Protective/Mitigation Measures

N/A.

3.4.3 Paleontological Resources

Affected Environment

The proposed wells are geographically located in cultivated fields overlying part of the geologic feature that is the eastern flank of the Denver Basin. The Basin consists of a large asymmetric syncline of Paleozoic, Mesozoic, and Cenozoic sedimentary rock layers, trending north to south along the east side of the Colorado Front Range from about Pueblo to the south, north up to Wyoming. The basin is deepest near Denver and ascends gradually to its eastern outcrop in central Kansas. The Pinedale and Bull Lake glaciation underlies the proposed well locations. The Pinedale and Bull Lake glaciation is a Class 3 geologic formation, according to the BLM's Potential Fossil Yield Classification (PFYC) System, which was created to assist in determining proper mitigation approaches for surface disturbing activities (WO IM2008-009). This is a Class 3 formation because it is moderately fossiliferous and indicates the potential for paleontologic resources. The potential for this proposed project to be sited on or impact a significant fossil locality is moderate.

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

Although the project area does not contain any known fossil resources, there is a possibility that ground disturbing work in the area may uncover fossil resources. Potential impacts to fossil localities could be both direct and indirect. Direct impacts to or destruction of fossils would occur from unmitigated activities conducted on formations with moderate potential for important scientific fossil resources. Indirect impacts would involve damage or loss of fossil resources due to the unauthorized collection of scientifically important fossils by workers or the public due to increased access to fossil localities in the Project Area. Adverse impacts to important fossil resources would be long-term and significant since fossils removed or destroyed would be lost to science. Adverse significant impacts to paleontological resources can be reduced to a negligible level through mitigation of ground disturbing activities, as described further below. It is possible that the Proposed Action would have the beneficial impact that ground disturbance activities might result in the discovery of important fossil resources.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts to paleontological resources would be the same as those described for the Proposed Action.

Protective/Mitigation Measures

The proposed construction of the well pads, access to the well pads, production facilities, and pipelines may penetrate the protective soil layer impacting the bedrock unit below. Because a moderately fossiliferous (Class 3) formation is present and susceptible to adverse impacts, mitigation measures are

recommended. In order to prevent potential impacts to paleontologic resources, a stipulation will be attached to the permit that directs the holder to notify the BLM RGFO immediately if any vertebrate fossils or their traces are discovered during operations within this project area. Operations may continue as long as the fossil specimen would not be damaged or destroyed by the activity.

If any significant fossils are found, development of a research design and data recovery may also be recommended before the project proceeds. Any fossils recovered on private land belong to the private landowner; however, the BLM recommends the use of a federally approved repository for storage of any fossils recovered in these efforts.

In many instances where the surface estate is not owned by the federal government, the mineral estate is, and is administered by the BLM. Paleontological resources are considered to be part of the surface estate. If the BLM is going to approve an action involving the mineral estate that may affect the paleontological resources, the action should be conditioned with appropriate paleontological mitigation recommendations to protect the interests of the surface owner. The surface owner may elect to waive these recommendations; such a waiver must be documented in the casefile.

3.4.4 Socioeconomic Resources

Affected Environment

The Proposed Action is located entirely within Weld County. Weld County's population was 263,691 in 2012, representing a 45.7% increase from 2000, compared to statewide Colorado population growth of 20.6% during the same period (USCB 2013). Weld County is comprised of a 28.4% Hispanic or Latino population, and an additional 2.1% minority population comprised primarily of Native Americans, African Americans and Asians (USCB 2012).

Weld County's economy is based on agriculture, construction, and natural resource production. Weld County's labor force totaled 2,710,732 people in 2011. Weld County's unemployment rate was 7.6%, which is lower than Colorado's June 2010 unemployment rate of 8.3% (USBLS 2010). Median household income was $57,685 in 2011. Weld County's poverty rate was 12.5% in 2011 (USBLS 2013).

In the past ten years, oil and gas development has increased steadily in Weld County. In 2002, gas production for all of Weld County was 184,047,870 million cubic feet (mcf), with sales of 180,176,671mcf. In 2012, gas production was 270,859,277mcf, with sales of 262,337,093mcf (COGIS 2013).

The federal government makes payments in lieu of taxes (PILT) to County governments to help offset property tax revenue lost on nontaxable federal lands within County boundaries (BLM 2006). The PILT distributions are based on acres for all Federal land management agencies (e.g., approximately 197,320 acres in Weld County). The amount may also be adjusted based on population and as appropriated by Congress. By formula, payments are decreased as other federal funds, such as mineral royalty payments, increase. PILT received by Weld County in the last five years are shown in Table 3-7.

Table 3-7. Federal Payments in Lieu of Taxes to Weld County

Year	PILT Amounts
2013	$341,191
2012	$67,022
2011	$65,048
2010	$65,053
2009	$83,351

Source: USDI NBC, 2013

In addition to PILT payments, the BLM shares revenue generated by commercial activities on public lands with state and county governments (BLM 2006). Federal mineral royalties are collected on oil and gas production from federal mineral leases. Half of the royalty receipts are distributed to Colorado; the $2,292,174 received by Weld County in 2012 was allocated to fund county services, schools, and local communities (DOLA 2012).

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

Direct impacts from the Proposed Action would include payments received from the leasing of federal mineral estate and potentially a minor increase in employment. Indirect impacts could include increased employment opportunities in industries related to oil and gas and economic benefit to federal, state, and county governments related to lease payments, royalty payments, severance taxes, and property taxes.

No Action Alternative (Direct and Indirect Impacts)

Under the No Action alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. There would be no direct impacts to socioeconomic resources because there would be no payments received from leasing of federal mineral estate; however, indirect impacts from the exploration and development of private land and private minerals would be the same as under the Proposed Action.

Protective/Mitigation Measures

No protective or mitigation measures are recommended due to the lack of effects to socioeconomic resources.

3.4.5 Noise

Affected Environment

Sound levels have been calculated for areas that exhibit typical land uses and population densities. In rural recreational and agricultural lands, ambient sound levels are expected to be approximately 30 to 40 decibels (dBA) (EPA 1974, Harris 1991). These typical noise levels result primarily from equipment operations during ranching and farming activities and vehicular traffic on rural roads. In comparison, the noise level during normal conversation of two people 5 feet apart is approximately 60 dBA.

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

Primary sources of noise during the drilling/development phase would be from equipment (bulldozers, drill rigs, and diesel engines). The movement of heavy vehicles and drilling could result in frequent-to-continuous noise. If noise-producing activities occur near a residential area, noise levels from blasting, drilling, and other activities could exceed Weld County's maximum permissible noise levels for non-specified areas, which are 55 dBA between 7:00 a.m. to 9:00 p.m. and 50 dBA from 9:00 p.m. through 7:00 a.m. The distance from well pad to the nearest residential property lines for Peaks K27-69-HN and Heitman K27-79HN are 655 and 665 feet, respectively, although residences are not necessarily located directly on the property lines. Sound is reduced over distance, and impacts from noise to surrounding residents would be expected to be minimal. There would be no effect to nearby residences because Weld County does not have applicable limits for oil and gas production.

No Action Alternative (Direct and Indirect Impacts

Under the No Action alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts to noise would be the same as those described for the Proposed Action.

Protective/Mitigation Measures

Mitigation would not be required. Provisions of the Weld County Noise Ordinances do not apply to any noise produced in the course of normal mining operations or oil and gas exploration and production (Sec. 14-9-60/L).

3.4.6 Wastes, Hazardous or Solid

Affected Environment

The BLM assumes that conditions associated with the Proposed Action Project Area, both surface and subsurface, are currently clean and that there is no known contamination. A determination would be made by the applicant prior to initiating the project, if there is evidence that demonstrates otherwise (such as solid or hazardous wastes have been previously used, stored, or disposed of at the project site).

Environmental Effects

Proposed Action (Direct and Indirect Impacts)

Contamination of soil or groundwater could occur as a result from an accidental spill or release of hazardous materials during construction and production phases. Spills or releases could result in contamination to soil and/or groundwater and exposure of maintenance workers and the public to hazardous materials. Runoff of contaminants into surface water could impact surface water quality. All hazardous substances brought to and stored on location would have a Material Safety Sheet (MSDS) and would be properly handled so as to not cause harm to the environment of people. MSDS would be kept on location until the hazardous material is properly disposed of in accordance with federal law. All undesirable events (fires, accidents, blowouts, spills, discharges) would be reported to the RGFO.

Possible contaminant sources associated with the drilling operations are:

- Storage, use and transfer of petroleum, oil and lubricants
- Produced fluids
- General hazardous substances, chemicals and/or wastes
- Concrete washout water
- Drilling water, mud and cuttings

No Action Alternative (Direct and Indirect Impacts)

Under the No Action alternative, the applicant could explore and develop the private land and private minerals and not access the federal minerals. Direct and indirect impacts from hazardous or solid wastes would be the same as those described for the Proposed Action.

Protective/Mitigation Measures

Impacts from hazardous or solid wastes would be avoided or reduced by the implementation of the mitigation measures outlined in Noble's 10-Point Drilling Program, which is included with the APD packages. Federal and state operating and reporting requirements include provisions to clean up and mitigate spills or releases of chemicals, products, or wastes. The BLM requires identification of the chemicals that would be used, stored, and produced during construction and operations. The Hazardous Substances Management Plan has been developed to prevent spills and illegal dumping of hazardous substances, and wastes. Storage, use, and transport of these materials and the disposal of generated wastes would comply with all pertinent federal regulations.

3.5 Cumulative Impacts

Cumulative impacts are those impacts that result from the incremental impact of a proposed project when added to other past, present, and reasonably foreseeable actions, regardless of which agency or person undertakes such actions. Past, present, and reasonably foreseeable future development in the project area primarily includes oil and gas development and livestock grazing, but it also includes oil shale, gilsonite, tar sands, sand and gravel, and other projects.

The Proposed Action would incrementally add approximately 22 acres of initial surface disturbance, which would be partially reclaimed, resulting in less than seven acres of permanent surface disturbance. Oil and gas development in the Project Area is a historic action and is proposed to continue for the known future. Approximately 13,041 (12,355 conventional and 686 coalbed natural gas wells) exploratory and development wells are projected to be drilled in the RGPA for the next twenty years (through 2030) resulting in approximately 44,440 acres of new short-term surface disturbance (BLM, 2012b).

3.5.1 Air Quality and Greenhouse Gases

The project region currently contains various emission sources including agricultural fields, traffic, houses, and oil and gas production. The addition of the infrastructure needed to construct, drill, and operate the additional pads and wells associated with the Proposed Action would have a cumulative impact to the area's air quality; however, given the project's relatively low emissions levels, the proposed wells' impact contribution to the cumulative effect would be minor. Over the long term, if economical quantities of oil and gas are found, additional wells can be expected to be drilled in the region. This could result in a larger cumulative impact to air quality in the future. Any development that would occur within the ozone

nonattainment area must comply with the additional emission control measures required by CDPHE for oil and gas activities in nonattainment areas.

Due to the spatial extent of oil and gas development, a regional-scale modeling analysis usually is warranted to determine the impacts associated with expansive cumulative increases in oil and gas development and operations. The BLM Colorado State Office is currently conducting a Colorado-wide cumulative oil and gas modeling study (the Colorado Air Resources Management Modeling Study or CARMMS) that would include analyses for each BLM Field Office, including the RGFO. For this study, oil and gas emissions increases would be projected and modeled out 10 years from year 2011, according to projected reasonably foreseeable development in the region, as well as recent oil and gas development growth data. These projections would be determined for each BLM Field Office in Colorado. Regional ozone and other pollutants and air quality related values (AQRVs) including visibility impacts would be evaluated in CARMMS. The study should be completed by spring 2014. As future oil and gas development occurs in the RGFO region, the BLM Colorado State Office plans to compare project-specific permitted levels of emissions to the RGFO oil and gas emissions rates modeled in CARMMS, along with the corresponding modeling results, to ensure that activities for which the BLM Colorado State Office grants permits would cumulatively remain within the acceptable emissions levels analyzed in CARMMS.

With respect to GHG emissions, the EPA identified a number of climate change predictions for the Mountain West and Great Plains region including but not limited to warmer temperatures, less snowfall, earlier snowmelt, and more frequent droughts (based on BLM 2012). If these predictions are realized, as mounting evidence suggests is already occurring, there could be impacts to natural resources within the region. The construction, operation, and maintenance of the two proposed wells would have a cumulative impact to GHG emissions; however, the proposed wells' impact would be minor. The BLM requirements listed in Section 3.2.1 (Protective/Mitigation Measures) would help minimize the project's GHG emissions and potential climate change impact.

3.5.2 Geologic and Mineral Resources

Drilling the two proposed wells would cumulatively and incrementally affect the area's geologic and mineral resources. The Proposed Action would drill through the Laramie-Fox Hills aquifer to produce hydrocarbons from underlying formations and would cumulatively contribute to the eventual depletion of such hydrocarbons. During drilling operations on parcels, loss of circulation or problems cementing the surface casing could cumulatively affect freshwater aquifer and mineral zones encountered. These impacts are avoided by following proper cementing and casing procedures.

3.5.3 Soils

Construction of the two well pads and associated infrastructure would result in initial surface disturbance of 22 acres, removing all vegetation present, which would cumulatively and incrementally affect erosion and sedimentation rates in this area. Surface disturbing activities that compact soil, increase soil erosion and sediment yield, and increase fugitive dust may also cumulatively and incrementally affect vegetation characteristics and integrity, as such changes to the landscape may decrease plant productivity and composition in the Project Area. However, given the project's relatively small footprint, the proposed wells' impact to soils would be minor.

3.5.4 Vegetation

Construction of the two well pads and associated infrastructure would result in initial surface disturbance of 22 acres, removing all vegetation present. The successful reclamation of wells would result in less than seven acres of permanent surface disturbance for the entire project. The Project Area is comprised primarily of cultivated crop land, which has already been converted from native grassland. The Proposed Action's contribution to cumulative changes to the natural vegetation setting in the RGPA is considered to be minor, relative to the cumulative disturbance from past, present and reasonable foreseeable oil and gas activity in the RGPA, estimated to be approximately 44,440 acres (BLM, 2012b).

3.5.5 Invasive Plants

The Project Area is comprised primarily of cultivated crop land, which has already been converted from native grassland. Construction of the two well pads and associated infrastructure would result in initial surface disturbance of 22 acres, removing all vegetation present and potentially facilitating the spread of invasive plants. The successful reclamation of wells would reduce the permanent surface disturbance to approximately five for the entire project. The Proposed Action would increase the potential for invasive plants to spread; however, its cumulative contribution to invasive plant introduction in the area is considered minimal due to the fact most of the surface disturbance generated by the Proposed Action is would be reclaimed and returned to active crop land.

3.5.6 Water (Surface and Groundwater, Floodplains)

Construction of the two well pads and associated infrastructure would result in initial surface disturbance of 22 acres and could cumulatively and incrementally affect wells and groundwater resources in the RGPA. The cumulative contribution to water resource effects would be minimized by: adherence to practices detailed in Noble's 10-Point Drilling Plans (submitted with the APD packages); any additional conditions of approval required by the BLM for individual wells; the setting of casing at appropriate depths; following safe remedial procedures in the event of casing failure; and, using proper cementing procedures. Implementation of these measures would help protect fresh water aquifers above the drilling target zone, including the Arapahoe and Laramie Fox-Hills aquifer systems, which serves as the primary fresh water resource underlying the Project Area.

3.5.7 Terrestrial Wildlife

Construction of the two well pads and associated infrastructure would initially result in the direct loss of 22 acres of wildlife habitat in the area; however, as noted in Section 3.3.3, the private lands on which the two wells are proposed are comprised primarily of cultivated crops and oil and gas development. As a result, wildlife in the area is limited to species that have adapted to the increased development activity. Over the long term, the permanent surface disturbance would be less than seven acres, reducing the impact by 15 acres. Although this project would cumulatively contribute to impacts to wildlife, the contribution would be minor compared to the past, present, and reasonably foreseeable future oil and gas development in the area (BLM, 2012a).

3.5.8 Migratory Birds

Construction of the two well pads and associated infrastructure would initially result in the direct loss of 22 acres of available cover, habitat, breeding and nesting areas, and foraging opportunities for migratory birds after successful reclamation. Although this project would cumulatively reduce migratory bird habitat in the Project Area, the impact from the Proposed Action would be very minor relative to the substantial amount of disturbance within the RGPA from past, present, and reasonably foreseeable future disturbance from oil and gas activity. While minor, the Proposed Action would also contribute to the cumulative, indirect effect on migratory birds as a result of increased human activity within the RGPA, triggering site avoidance where activities and noise are intense.

3.5.9 Socioeconomic Resources

The socioeconomic effects to the region from the exploration and production of oil and gas are considered beneficial. The cumulative effect includes increased payments received from the leasing of federal mineral estate, as well as indirect effects such as increased employment opportunities in industries related to oil and gas and economic benefit to federal, state, and county governments related to lease payments, royalty payments, severance taxes, and property taxes. The Proposed Action's contribution to this beneficial effect is considered minor with the addition of two wells, in light of the amount of oil and gas development in the region from past, present, and reasonably foreseeable projects in this industry.

3.5.10 Noise

Past, present, and reasonably foreseeable future actions from oil and gas exploration and production would result in an increase in noise, but given the Proposed Action's small footprint and adherence to noise ordinances, the cumulative effect is considered minor relative to overall noise increases within the RGPA from other projects. Additionally, provisions of the Weld County Noise Ordinance do not apply to any noise produced in the course of normal mining operations or oil and gas exploration and production (Sec. 14-9-60/L), so cumulative noise effects cannot be quantified for significance.

3.5.11 Cultural Resources

Because no historic properties were found, there will be no cumulative impact to any resources from this undertaking.

3.5.12 Native American Religious Concerns

Because no properties of traditional religious and cultural significance were identified by the tribes, there would be no cumulative impact to these resources from this undertaking.

3.5.13 Paleontological

Past, present, and reasonably foreseeable future actions associated with surface disturbing activities from oil and gas exploration and production and other land uses could cumulatively impact common fossils, but are unlikely to result in significant effects to paleontological resources. The proposed construction of the well pads, access to the well pads, and pipelines may penetrate the protective soil layer impacting the paleontologic resources that are potentially located in the bedrock unit below. Because a moderately

fossiliferous (Class 3) formation is present and susceptible to adverse impacts, mitigation measures, including inventories, monitoring and possibly recovery, are recommended to reduce impacts to paleontological resources on a project-by-project basis, as noted previously in Section 3.4.3. Implementation of these measures for other cumulative projects in the region would minimize the cumulative effect on paleontological resources and any potential loss of scientific knowledge.

3.5.14 Wastes, Hazardous or Solid

Past, present, and reasonably foreseeable future actions from oil and gas exploration and production would result in an increase in waste generation; however, adherence to regulatory requirements and best management practices by all oil and gas developers, as described in Section 3.4.6, would minimize cumulative environmental and safety effects from hazardous or solid waste use and disposal.

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CHAPTER 4 - CONSULTATION AND COORDINATION

4.1 Interdisciplinary Team Reviewers and List of Preparers

The following list of ID Team members participated in the project kickoff meeting; only those with resources analyzed in the EA participated in the review and completion of the document.

BLM ID Team Reviewers

ID Team Member	Resource Reviewed/Position
Jay Raiford	Assistant Field Manager, Nonrenewable Resources
Martin Weimer	District NEPA Coordinator
Aaron Richter	Acting NRS, BLM Project Manager
Matt Rustand	Wildlife
John Lamman	Range and Invasive Plants
Dave Gilbert	Riparian/Wetlands and Aquatic Wildlife
Jeff Covington	Cadastral Survey
Marvin Hendricks	Fluid Minerals
Monica Weimer	Cultural and Native American Resources
Melissa Smeins	Geology, Minerals, Paleontology
Melissa Garcia	Assistant Field Manager, Renewable Resources
Kalem Leonard	Recreation

List of Preparers

Name	Company	Area(s) of Participation
Lisa Sakata	ICF International	Project Manager, EA preparation, NEPA review Wildlife, Vegetation, Invasive Species, T&E Species, and Migratory Birds
David Ernst	ICF International	Air quality
Merin Swenson	ICF International	Geology, Soils, Water, Paleontology, Wastes, and Noise
Eric Pitcher	ICF International	GIS analysis and map production
Nate Wagoner	ICF International	QA/QC
Karen DiPietro	ICF International	Document preparation

4.2 Tribes, Individuals, Organizations, or Agencies Consulted

- Apache Tribe of Oklahoma
- Cheyenne and Arapaho Tribes of Oklahoma
- Cheyenne River Sioux Tribe
- Comanche Tribe of Oklahoma
- Crow Creek Sioux
- Eastern Shoshone
- Jicarilla Apache Nation
- Kiowa Tribe of Oklahoma
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- The Ute Tribe
- Oglala Sioux Tribe
- Pawnee Tribe
- Rosebud Sioux Tribe
- Southern Ute Tribe
- Standing Rock Lakota Tribe
- Ute Mountain Ute Tribe
- State Historic Preservation Office, Colorado
- Advisory Council on Historic Preservation

CHAPTER 5 - REFERENCES

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)

DOI-BLM-CO-F02-2014-006

Based on review of the EA and the supporting documents, I have determined that the project is not a major federal action and will not have a significant effect on the quality of the human environment, individually or cumulatively with other actions in the general area. No environmental effects from any alternative assessed or evaluated meet the definition of significance in context or intensity, as defined by 43 CFR 1508.27; therefore, an environmental impact statement is not required. This finding is based on the context and intensity of the project as described below:

RATIONALE:

Context: The BLM has received two (2) Application Permits to Drill (APDs), proposing the construction of two well pads, associated access roads, connecting pipelines, and the drilling of two horizontal oil wells on private surface estates/over private mineral estates, in order to develop private and federal minerals (fee/fee/fed) in the south east part of Weld County approximately 10 miles from the town of Greeley, Colorado. The federal mineral estate is leased and subject to oil and gas development.

The general area description would be defined as rural farmland and located in the northern portion of the South Platte River Basin, Colorado, used primarily for crop production and oil and gas development. There are a few county roads in the project area and one state highway nearby. Access is limited to private or petroleum field roads over private surface. The roadways vary in development but most are dirt/primitive roads.

Extensive oil and gas development has occurred in the nearby Wattenberg field, mostly on a private mineral estate.

Intensity: I have considered the potential intensity/severity of the impacts anticipated from the proposed Peaks Federal K27-69-HN and Heitman Federal K27-79HN APDs. The project decision relative to each of the ten areas suggested for consideration by the CEQ is documented below:

1. **Impacts that may be beneficial and adverse:**

   There would be minor impacts to air quality from the proposed wells. Most of this would occur during the construction and drilling phases. Potential impacts might occur to ground water; however, such impacts should not occur if strict drilling requirements are followed. Other minor impacts might occur to wildlife and migratory birds but would be mitigated through the use of timing stipulations. Positive impacts include benefits in royalties and revenue generated to the federal government from productive wells. Other indirect effects could include economic benefits to state and county governments related to royalty payments and severance taxes. Other beneficial impacts from the action would be the potential for productive wells being created that would add, albeit in a small way, to national energy independence.

2. **Public health and safety:**

   The Proposed Action would have a temporary, localized negative impact to air quality during the construction phase. Surface disturbance, utilization of the access road, and construction activities such as drilling, hydraulic fracturing, well completion, and equipment installation would impact air quality through the generation of dust related to earthmoving, travel, transport, and general construction. This phase would also produce short-term emissions of criteria pollutants,

hazardous air pollutants (HAPs), and greenhouse gases (GHGs) from vehicle and construction equipment exhaust. The primary GHGs are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Once construction is complete, the daily activities at the site would be reduced to operational and maintenance checks which may be as frequent as daily visits. Emissions would result from vehicle exhaust from the maintenance and process technician visits, as well as oil and produced water collection or load out trips. The pads can be expected to produce fugitive emissions of well gas and liquid flashing gases, which contain a mixture of methane, volatile organic compounds (VOCs), HAPs, and inert or non-regulated gases. Fugitive emissions are emissions that are not associated with a stack, exhaust vent, or other defined point. Fugitive emissions may result from pressure relief valves and working and breathing losses from any tanks located at the sites, as well as any flanges, seals, valves, or other infrastructure connections used at the sites. Liquid product load-out operations would also generate fugitive emissions of VOCs.

3. Unique characteristics of the geographic area:

The EA evaluated the area of the proposed action and determined that no unique geographic characteristics were present. These areas include wild and scenic rivers, prime or unique farmlands, Areas of Critical Environmental Concern, designated wilderness areas, Wilderness Study Areas, and Lands with Wilderness Characteristics.

4. Degree to which effects are likely to be highly controversial:

The potential for controversy associated with the effects of the proposed action is low. The action is proposed on private surface over private minerals, with penetration into federal minerals. There is no disagreement or controversy among ID team members or reviewers over the nature of the effects on the relevant resources.

5. Degree to which effects are highly uncertain or involve unique or unknown risks:

The drilling of oil and gas wells has occurred in the area over the past century; although the potential risks involved can be controversial, they are neither unique nor unknown. Numerous other well locations have been successfully drilled in this area of Weld County.

6. Consideration of whether the action may establish a precedent for future actions with significant impacts:

The proposed APDs will be limited to standard construction procedures associated with pad/road construction and drilling in Weld County and have occurred historically on split and private mineral estate. There are no aspects of the current proposal that are precedent setting.

7. Consideration of whether the action is related to other actions with cumulatively significant impacts:

The action is a continuation of oil and gas activities that have historically occurred in the area. Continued oil and gas activity in the area will have minor but additive impacts to air and the production greenhouse gas emissions. The project area has been subject to historic drilling activity and will continue to experience gradual depletion of the recoverable oil and gas products as anticipated in the RFD (BLM, 2012b).

8. Scientific, cultural or historical resources, including those listed in or eligible for listing in the National Register of Historic Places:

Construction and operation of the proposed wells and infrastructure will have no effect on historic properties.

9. Threatened and endangered species and their critical habitat:

No threatened, endangered, or candidate species or their habitats are located within the action area.

10. Any effects that threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment:

The proposed action conforms with the provisions of NEPA (U.S.C. 4321-4346) and FLPMA (43 U.S.C. 1701 et seq.) and is compliant with the Clean Water Act and The Clean Air Act, the National Historic Preservation Act, Migratory Bird Treaty Act (MBTA) and the Endangered Species Act.

NAME OF PREPARER:	ICF International
BLM PROJECT LEAD	/s/ Aaron Richter
SUPERVISORY REVIEW:	/s/ Jay Raiford
NAME OF ENVIRONMENTAL COORDINATOR:	/s/ Martin Weimer
	Martin Weimer
DATE:	02/28/14
SIGNATURE OF AUTHORIZED OFFICIAL:	/s/ Jay Raiford
	For Keith E. Berger, Field Manager
DATE SIGNED:	2/28/14

United States Department of the Interior
Bureau of Land Management
Royal Gorge Field Office

DECISION RECORD

DOI-BLM-CO-F02-2014-06-EA

DECISION:

It is my decision to authorize the proposed action as described in the attached EA. The proposed action is to construction three well pads, associated access roads, connecting pipelines, and the drilling of three horizontal oil wells on private surface estates/over private mineral estates, in order to develop private and federal minerals (fee/fee/fed). Access to the proposed Peaks Federal K27-69-HN and Heitman Federal K27-79HN projects would primarily be gained by traveling on existing state and county roads.

The proposed project is located in the south east portion of Weld County approximately 10 miles from the town of Greeley, Colorado. The federal mineral estate within the project boundary is leased and subject to oil and gas development.

The proposed action was analyzed in the Environmental Assessment (EA) DOI-BLM-CO-F02-2014-06, and a Finding of No Significant Impact was reached; an EIS will not be prepared.

RATIONALE:

This APD will develop oil and gas resources on federal minerals Lease COC52545 consistent with existing federal lease rights provided for in the Mineral Leasing Act of 1920, as amended. Extensive oil and gas development has occurred throughout the project area, mostly on private mineral estate.

The project area currently has a high degree of alteration in the form of active crop land, fields, roads, houses, and oil and gas production. The addition of the infrastructure needed to construct and drill the three proposed wells would have mostly temporary and overall minor impacts on resources present in the project area.

MITIGATION MEASURES/MONITORING:

Air Quality: Noble will comply with Colorado Oil and Gas Commission (COGCC) Rule 805 which requires control of VOC emissions, odors, and fugitive dust. Noble will use industry best practices, including watering, graveling, and reseeding to reduce fugitive dust emissions from vehicular traffic and disturbed surfaces. Interim reclamation and existing agricultural practices will be implemented in order to stabilize the site and prevent fugitive dust from being generated. In addition the following BLM requirements will apply:

- Process equipment would be permitted by CDPHE in accordance with applicable requirements and required emissions standards to limit the facility's potential to emit and provide appropriate operating, monitoring, and recordkeeping requirements.
- VOC emissions from storage tanks would be controlled using control technology that would reduce VOC emissions by at least 95 percent relative to uncontrolled conditions.
- The operator would control fugitive emissions of particulate matter (dust) during construction and production, using procedures and control technology that would reduce dust emissions by at least 50 percent relative to uncontrolled conditions.
- All pump engines would be required to meet EPA Non-Road Tier II emissions standards.
- All drill rig engines would be required to meet EPA Non-Road Tier II emissions standards.
- The operator would perform 'Green Completions' for all wells, as required by COGCC Rule 805.b(3).
- All continuous-bleed devices would operate at "low-bleed" rates. If a "high-bleed" device is needed Noble would obtain approval from the CDPHE Air Pollution Control Division in accordance with CDPHE Regulation 7.XVIII.C.3 (5 CCR 1001-9).
- Noble would take every possible precaution to minimize uncontrolled gas venting associated with well blowdowns or maintenance activities.

Geology and Mineral Resources: If the proposed project plans to utilize federal minerals in the construction of roads, pad building or for any other construction needs, then compliance with 43 CFR 3600 is required. The project proponent will need to submit an application for a mineral materials disposal with BLM, prior to any disturbance being initiated. Federal mineral materials regulations also apply to split estate (i.e., a private surface landowner could not dispose of federal mineral materials for this project, surface or subsurface, without prior authorization from the BLM).

BLM Onshore Order #2 (OO#2) requires that the proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. A review at the APD stage includes a geologic evaluation of the potential subsurface formations that will be penetrated by the wellbore, followed by an engineering analysis of the drilling program to ensure the well construction design is adequate to protect the surface and subsurface environment, including the potential risks identified by the geologist, and all known or anticipated zones with potential risks.

Geologic and engineering reviews have been done to ensure that cementing and casing programs are adequate to protect all downhole resources. Known water bearing zones in the APD areas are protected by drilling requirements and, with proper practices, contamination of ground water resources is highly unlikely. Casing along with cement would be extended beyond fresh-water zones to insure that drilling fluids remain within the well bore.

Migratory Birds: To be in compliance with the Migratory Bird Treaty Act (MBTA) and the Memorandum of Understanding between BLM and USFWS required by Executive Order 13186, BLM must avoid actions, where possible, that result in a "take" of migratory birds. Pursuant to BLM Instruction Memorandum 2008-050, to reduce impacts to Birds of Conservation Concern (BCC), no habitat disturbance (removal of vegetation such as timber, brush, or grass) is allowed during the periods of May 15 - July 15, during the breeding and brood rearing season for most Colorado migratory birds. An exception to this timing limitation will be granted if nesting surveys conducted no more than one week prior to surface-disturbing activities indicate no nesting within 30 meters (100 feet) of the area to be disturbed. Surveys shall be conducted by a qualified breeding bird surveyor between sunrise and 10:00 a.m. under favorable conditions. This provision does not apply to ongoing construction, drilling, or completion activities that are initiated prior to May 15 and continue into the 60-day period.

The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds from entering, and to discourage perching, roosting, and nesting. Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, and in-line units. Any action that may result in a "take" of individual migratory birds or nests that are protected by MBTA will not be allowed.

Paleontological Resources: In many instances where the surface estate is not owned by the federal government, the mineral estate is, and is administered by the BLM. Paleontological resources are considered to be part of the surface estate. If BLM is going to approve an action involving the mineral estate that may affect the paleontological resources, the action should be conditioned with appropriate paleontological mitigation recommendations to protect the interests of the surface owner. The surface owner may elect to waive these recommendations; such a waiver must be documented in the casefile.

Wastes, Hazardous or Solid: Impacts from hazardous or solid wastes would be avoided or reduced by the implementation of the mitigation measures outlined in Noble's 10-Point Drilling Program, which is included with the APD packages.

PROTEST/APPEALS:

This decision shall take effect immediately upon the date it is signed by the Authorized Officer, and shall remain in effect while any appeal is pending unless the Interior Board of Land Appeals issues a stay (43 CFR 2801.10(b)). Any appeal of this decision must follow the procedures set forth in 43 CFR Part 4. Within 30 days of the decision, a notice of appeal must be filed in the office of the Authorized Officer at the Royal Gorge Field Office, 3028 E. Main, Cañon City, Colorado, 81212. If a statement of reasons for the appeal is not included with the notice, it must be filed with the Interior Board of Land Appeals, Office of Hearings and Appeals, U.S. Department of the Interior, 801 North Quincy St., Suite 300, Arlington, VA 22203 within 30 days after the notice of appeal is filed with the Authorized Officer.

SIGNATURE OF AUTHORIZED OFFICIAL: /s/ Jay Raiford

For Keith E. Berger, Field Manager

DATE SIGNED: 2/28/14

APPENDIX A. AIR QUALITY

This appendix provides the air pollutant emission inventory prepared by Noble Energy, Inc. to support the EA for the proposed wells and associated infrastructure. Emissions of the following pollutants were inventoried: CO, NOx (including NO_2), $PM_{2.5}$, PM_{10}, SO_2, and VOC. For combustion sources, greenhouse gas emissions were calculated for CO_2, CH_4, and N_2O. HAP emissions were calculated for production activities. Development of the lease could lead to surface disturbance from the construction of well pads, access roads, pipelines, and power lines, as well as associated air pollutant emissions from windblown dust and equipment and vehicle exhaust. The analysis includes construction emissions (well pad and access road construction), drilling emissions, completion emissions, and production emissions (vehicle traffic and on-site equipment). It was assumed that each well pad would contain a single well. The emission inventory was developed using reasonable but conservative scenarios developed by Noble Energy for each activity. Production emissions were calculated based on full production activity. This appendix presents the inventory in the following sections: project (2 wells) summary, per-well summary, construction, drilling and drill rig moving, completion, and production. Relevant assumptions are provided in each section.

NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS
PROPOSED ACTION EMISSIONS

Overall Inputs

Description	Prop. Action
Total no. of wells	2
Production years	20

Note: emissions unit is US short ton (2,000 lb) unless metric tons (tonnes) are specified.

Emissions Summary for Proposed Action (all wells)

Description	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	CO_2	CH_4	N_2O	CO_2e		
One-Time Emissions (tons)										tons	tonnes	10^6 tonnes
Construction	0.72	0.20	0.0699	1.02	0.1593	0.0787	106	0.0011	0.0014	106.0	96.2	0.00010
Rig Move & Drilling	3.18	3.31	0.3838	0.45	0.0356	0.0009	1,740	0.0061	0.0064	1,742.4	1,580.7	0.00158
Completion	0.24	0.48	0.1694	0.27	0.0267	0.0002	254	0.0027	0.0005	254.3	230.7	0.00023
Total One-Time Emissions	4.14	4.00	0.6231	1.74	0.2217	0.0798	2,100	0.0100	0.0083	2,102.7	1,907.5	0.00191
Annual Emissions (tons/year)												
Production*	2.16	4.08	11.93	1.57	0.1568	0.0007	2,140	0.1909	0.0043	2,144.9	1,945.8	0.00195
Total One-Time GHG Emissions plus 1 year production (tons)							4,240	0.2009	0.0126	4,247.6	3,853.4	0.00385
Total One-Time GHG Emissions plus Life-of-Well (20 years) GHG Emissions (tons)							44,892	3.8284	0.0948	45,001	40,824	0.04082
Global Warming Potentials for CO2e calculation (Forster *et al.* 2007)							1	21	298			

* Production emissions from all wells are less than the single well total times the number of wells because there is only one compressor engine, which serves the output of all wells connected to the production facility. The engine exhaust emissions are included in the total for the first well only.

Emissions Summary for Proposed Action - Conformity Evaluation

Description	NO_X	VOC
One-Time Emissions (tons)		
Construction	0.72	0.07
Rig Move & Drilling	3.18	0.38
Completion	0.24	0.17
Total One-Time Emissions	4.14	0.62
Annual Emissions (tons/year)		
Production (excludes CDPHE-permitted emissions*)	3.71	4.24
Hypothetical Worst-Case Year: Total One-Time Emissions plus 1 Year of Production Emissions (tons)	7.85	4.87
General Conformity threshold (tons/year)	100	100
* Production: CDPHE-permitted emissions only	0.08	8.50

1 Source for analysis: Noble Energy Inc. File <DP2 Generic 1 Well Emission Calculations 2014-01-24.xlsx>

NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS
EMISSIONS PER WELL

Type	Generic 1-Well Pad
Location	DP2 Well Sites
County	Weld County, CO

Site Information

Number of wells on pad	1
Type of Well	Horizontal
Days drilling per well (days)	10
New well pad disturbed area (acres)	8
Length of new road (feet)	5,280
Road width (ft)	25
Total acres disturbed	11.0
Type of Drill Rig	Diesel
Estimated Condensate (bbl/yr)	50,000
Condensate VOC (lb/bbl)	3.00
Estimated Water (bbl/yr)	30,000
Produced Water VOC (lb/bbl) (CDPHE default value)	0.262

Includes low flash condensate storage and truck loading controls

Emissions Summary (1 Pad)

	Criteria Pollutant Emissions (tons/year)						GHG Estimates (tons/yr)		
	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	CO_2	CH_4	N_2O
Construction	0.362	0.101	0.035	0.509	0.080	0.0394	52.80	0.0006	0.0007
Rig Move & Drilling	1.589	1.657	0.192	0.226	0.018	0.0005	870	0.0031	0.0032
Completion	0.122	0.242	0.085	0.134	0.013	0.0001	127	0.0014	0.0002
Production	1.892	3.660	6.372	0.784	0.078	0.0003	1,921	0.1019	0.0038
Total one-time emissions plus one year of production emissions	**3.965**	**5.660**	**6.683**	**1.652**	**0.189**	**0.0402**	**2,972**	**0.1069**	**0.0079**

Note: tons = US short tons unless metric tons (tonnes) are specified.

CO2e (tonnes/yr)	2,972	2.25	2.36
Total CO2e (tonnes/yr)			2,976

GHG Calculation Method (BLM 2011)	$CO_2 = 525 \times CO$
	$CH_4 = 0.016 \times VOC$
	$N_2O = 0.002 \times NOx$

Source for analysis: Noble Energy Inc. File <DP2 Generic 1 Well Emission Calculations 2014-01-24.xlsx>

1

NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Construction activities: Build new roads and well pads

Emissions Summary for Construction

(ton/yr)

NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
0.3617	0.1006	0.0349	0.5086	0.0797	0.0394

Duration

Activity	No. of Days
Days of construction (12 hr ea)	14
Days of bulldozer work (10 hr ea)	14

Earth Moving

			Emissions (ton/yr)		
			TSP	PM-2.5	PM-10
Per EPA AP-42 sec. 13.2.3	1.2	tons TSP/acre/mo			
Per EPA AP-42 sec. 13.2.4	0.35	ton PM10/ton TSP			
(EPA 1995a, EPA 1996a)	0.1	ton PM2.5/ton PM10	1.286869	0.04504	0.450404
	50%	Control efficiency for watering			

Vehicle Road dust

		PM-2.5	PM-10
Per EPA AP-42 sec. 13.2.2-2			
Equation 1(a)	k (lb/VMT)	0.15	1.5
(EPA 1996b)	a	0.9	0.9
	b	0.45	0.45
	s (silt content %)	5.1	

W = mean vehicle weight (tons)

E = k (s/12)^a (W/3)^b

E = size specific factor (lb/VMT)

				Factor (lb/VMT)		Emissions (lb/yr)		Emissions (ton/yr)	
Vehicle	GVW (tons)	Round Trips	VMT	PM-2.5	PM-10	PM-2.5	PM-10	PM-2.5	PM-10
Low boy hauler	43	1	2	0.229	2.289	0.229	2.289	0.0001	0.0011
Gravel hauler	27	1	2	0.187	1.867	0.187	1.867	0.0001	0.0009
100 bbl water truck	27	14	28	0.187	1.867	2.613	26.132	0.0013	0.0131
Work truck	4	28	56	0.079	0.790	2.213	22.132	0.0011	0.0111
Total								0.0026	0.0262
		Control efficiency for watering	50%						

Equipment Exhaust

			Factors (g/hp-hr)*						Emissions (ton/yr)					
Equipment	hp	hrs	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
Diesel bulldozer	300	140	7.81	2.15	0.75	0.692	0.692	0.851	0.3613	0.0994	0.0347	0.0320	0.0320	0.0394

* Factors from AP-42 Volume II (EPA 1985)

Vehicle Exhaust

			Factors (g/VMT)*						Emissions (ton/yr)					
Vehicle	Round Trips	VMT	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
Low boy hauler	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
Gravel hauler	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
100 bbl water truck	14	28	11.44	14.74	5.69	n/a	n/a	0.32	0.000353	0.000455	0.000175			0.000010
Work truck	28	56	0.65	9.66	0.56	n/a	n/a	n/a	0.000040	0.000596	0.000035			
Total									0.000443	0.001115	0.000235			0.000011

* Factors from AP-42 Volume II (EPA 1985)

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Rig Move & Drilling Activities

Emissions Summary for Rig Move & Drilling

(ton/yr)

NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
1.59	1.66	0.19	0.23	0.02	0.00

Vehicle Road dust

Per EPA AP-42 sec. 13.2.2-2

		PM-2.5	PM-10
Equation 1(a)	k (lb/VMT)	0.15	1.5
(EPA 1996b)	a	0.9	0.9
	b	0.45	0.45
	s (silt content %)	5.1	

W = mean vehicle weight (tons)

E = k (s/12)^a (W/3)^b

E = size specific factor (lb/VMT)

Vehicle	GVW (tons)	Round Trips	VMT	Factor (lb/VMT) PM-2.5	Factor (lb/VMT) PM-10	Emissions (lb/yr) PM-2.5	Emissions (lb/yr) PM-10	Emissions (ton/yr) PM-2.5	Emissions (ton/yr) PM-10
Rig movers	40	75	150	0.223	2.228	16.708	167.080	0.0084	0.0835
Fuel tanker	20	5	10	0.163	1.631	0.815	8.154	0.0004	0.0041
Logging truck	20	1	2	0.163	1.631	0.163	1.631	0.0001	0.0008
Cementer truck	30	1	2	0.196	1.957	0.196	1.957	0.0001	0.0010
Cement supply truck	40	2	4	0.223	2.228	0.446	4.455	0.0002	0.0022
130 bbl water truck	40	3	6	0.223	2.228	0.668	6.683	0.0003	0.0033
100 bbl water truck	30	20	40	0.196	1.957	3.914	39.145	0.0020	0.0196
Gas LDV - bits	2	20	40	0.058	0.579	1.157	11.573	0.0006	0.0058
Gas LDV - employee	2	200	400	0.058	0.579	11.573	115.726	0.0058	0.0579
Total								0.0178	0.1782

Control efficiency for watering 50%

Vehicle Exhaust

Vehicle	Round Trips	VMT	Factors (g/VMT)* NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	Emissions (ton/yr) NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
Rig hauler	75	150	11.44	14.74	5.69	n/a	n/a	0.32	0.001890	0.002435	0.000940			0.000053
Fuel tanker	5	10	11.44	14.74	5.69	n/a	n/a	0.32	0.000126	0.000162	0.000063			0.000004
Logging truck	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
Cementer truck	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
Cement supply truck	2	4	11.44	14.74	5.69	n/a	n/a	0.32	0.000050	0.000065	0.000025			0.000001
130 bbl water truck	3	6	11.44	14.74	5.69	n/a	n/a	0.32	0.000076	0.000097	0.000038			0.000002
100 bbl water truck	20	40	11.44	14.74	5.69	n/a	n/a	0.32	0.000504	0.000649	0.000251			0.000014
Gas LDV - bits	20	40	0.65	9.66	0.56	n/a	n/a	n/a	0.000029	0.000426	0.000025			
Gas LDV - employee	200	400	0.65	9.66	0.56	n/a	n/a	n/a	0.000286	0.004256	0.000247			
Total									0.003011	0.008155	0.001612			0.000075

* Factors from AP-42 Volume II (EPA 1985)

Drill Rig

Equipment	Fuel	hp	hr/day	Factors (g/hp-hr)** NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	Emissions (ton/yr) NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
Drill rig engines	Diesel	2400	24	2.5	2.6	0.3	0.075	0.075	0.0006	1.586	1.649	0.190	0.048		0.000

** Tier 2 Levels

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Completion Activities

Emissions Summary for Completion

(ton/yr)

NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
0.12	0.24	0.08	0.13	0.01	0.00

Vehicle Road dust

Per EPA AP-42 sec. 13.2.2-2
Equation 1(a)
(EPA 1996b)

	PM-2.5	PM-10
k (lb/VMT)	0.15	1.5
a	0.9	0.9
b	0.45	0.45
s (silt content %)	5.1	

W = mean vehicle weight (tons)

E = k (s/12)^a (W/3)^b

E = size specific factor (lb/VMT)

Vehicle	GVW (tons)	Round Trips	VMT	Factor (lb/VMT) PM-2.5	Factor (lb/VMT) PM-10	Emissions (lb/yr) PM-2.5	Emissions (lb/yr) PM-10	Emissions (ton/yr) PM-2.5	Emissions (ton/yr) PM-10
Casing hauler	50.0	1	2	0.246	2.463	0.246	2.463	0.0001	0.0012
Completion rig	42.5	1	2	0.229	2.289	0.229	2.289	0.0001	0.0011
Logging truck	17.5	1	2	0.154	1.536	0.154	1.536	0.0001	0.0008
Cementer truck	27.0	1	2	0.187	1.867	0.187	1.867	0.0001	0.0009
Sand truck	42.5	2	4	0.229	2.289	0.458	4.579	0.0002	0.0023
Frac pumper	42.5	1	2	0.229	2.289	0.229	2.289	0.0001	0.0011
Frackmaster deliver	42.5	1	2	0.229	2.289	0.229	2.289	0.0001	0.0011
130 bbl water truck	42.5	100	200	0.229	2.289	22.893	228.935	0.0114	0.1145
100 bbl water truck	27.0	5	10	0.187	1.867	0.933	9.333	0.0005	0.0047
Gas LDV - employee	2.0	20	40	0.058	0.579	1.157	11.573	0.0006	0.0058
Total								0.0134	0.1336

Control efficiency for watering 50%

Vehicle Exhaust

Vehicle	Round Trips	VMT	Factors (g/VMT)* NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	Emissions (ton/yr) NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
Casing hauler	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
Completion rig	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
Logging truck	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
Cementer truck	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
Sand truck	2	4	11.44	14.74	5.69	n/a	n/a	0.32	0.000050	0.000065	0.000025			0.000001
Frac pumper	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
Frackmaster deliver	1	2	11.44	14.74	5.69	n/a	n/a	0.32	0.000025	0.000032	0.000013			0.000001
130 bbl water truck	100	200	11.44	14.74	5.69	n/a	n/a	0.32	0.002520	0.003247	0.001253			0.000070
100 bbl water truck	5	10	11.44	14.74	5.69	n/a	n/a	0.32	0.000126	0.000162	0.000063			0.000004
Gas LDV - employee	20	40	0.65	9.66	0.56	n/a	n/a	n/a	0.000029	0.000426	0.000025			
Total									0.002876	0.004094	0.001441			0.000080

* Factors from AP-42 Volume II (EPA 1985)

Frac Pump Emissions

Equipment	# of pumps	hp	Durat. (hr)	Factors (g/hp-hr) NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	Emissions (ton/yr) NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
Frac pumps	6	1500	12	1	2	0.7	n/a	n/a	n/a	0.1189	0.2379	0.0833			

Flowback Venting

No venting.

Green completions with gas going to sales as soon as possible. Likely flared prior to sales if necessary.

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Production Activities

Emissions Summary for Production

(ton/yr)

NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
1.89	3.66	6.37	0.78	0.08	0.00034

Production Facilities

				Liquids Handling Emission Factors (lb/bbl)				Emissions (tons/yr)						General Conformity Status for
Source	Size	Units	Hours/year	VOC	Benzene	n-Hexane	Control Efficiency	NOx	CO	VOC	Benzene	n-Hexane	Comments	VOC & NOx
Condensate Tanks	50,000	bbl		3.000	0.0053	0.046	95.00%	0.01	0.08	3.75	0.0066	0.057	A, B	Exempt (has CDPHE air permit)
Truck Loading	50,000	bbl		0.242	0.00042	0.0037	95.00%	0.01	0.08	0.30	0.00053	0.0046	C, F	Exempt (has CDPHE air permit)
Produced Water Tanks	30,000	bbl		0.262	0.01	0.02	95.00%	0.01	0.05	0.20	0.0053	0.017	A, F	Exempt (has CDPHE air permit)
							Subtotal conformity exempt emissions	0.04	--	4.25	0.012	0.079		
Separator Heater	0.750	MMBtu/hr	8760					0.22	0.18	0.01	--	--	D	Included in conformity analysis
Fugitive Emissions								--	--	1.29	--	--	E	Included in conformity analysis
							Subtotal All Devices Except Compressor Engine	0.26	0.18	5.55	0.012	0.079		
Compressor Engine (VRU)	84	hp	See engine calculation sheet					1.62	3.24	0.81	0.0022	--		Included in conformity analysis
							Subtotal conformity included emissions	1.84	--	2.12	--	--		
Total								1.88	3.64	6.37	0.015	0.079		

Derivation of HAP Emission Factors by Ratio of VOC to CDPHE Defaults				
Description	VOC	VOC Ratio	Benzene	n-Hexane
CDPHE default factors	13.7	n.a.	0.024	0.21
Condensate Tanks	3.000	0.219	0.0053	0.046
Truck Loading	0.242	0.018	0.00042	0.0037

Combustion Emission Factors					
Description	Heat Value (btu/scf)	NOx	CO	VOC	Reference
Flare (lb/Mmbtu)	1,500	0.068	0.370	95% eff.	AP-42 Ch 13.5 Table 13.5-1 (EPA 1991)
Heater (lb/MMscf)	1,500	100	84	5.5	AP-42 Ch 1.4 Table 1.4-1 (EPA 1998)

Production Facilities Table Comments

A. Emissions from the condensate and water storage tanks are controlled using an enclosed flare as required by CDPHE. NOx & CO are calculated based on combusting the gas; VOC is calculated as 5% of what goes to the flare.

B. Condensate VOC emission factor is for representative well with a site-specific emission factor of 0.34 lb VOC/bbl. Value of 3.0 lb VOC/bbl used in table is a conservative estimate. Documentation of the site-specific emission factor is provided in the Administrative Record for the EA (file <Ptasnik LC29-72HN Emission Factor Package.pdf>).

C. Truck loading emissions are routed to the storage tanks and then through the vent system to the enclosed flare. Calculated as above.

D. Added as requested by BLM -- CDPHE APEN exempt source (non-reportable).

E. Added as requested by BLM -- CDPHE APEN reportable/Permit Exempt source. Calculated from Fugitives tab.

F. Emission factors are CDPHE default values.

Production Facilities -- HAPs Summary

	Emissions (tons/yr)					
Source	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Formaldehyde	n-Hexane
Condensate Tanks	nd	nd	0.0066	nd	nd	0.057
Truck Loading	nd	nd	0.00053	nd	nd	0.0046
Produced Water Tanks	nd	nd	0.0053	nd	nd	0.017
Separator Heater	nd	nd	0.01	nd	nd	nd
Fugitive Emissions	nd	nd	nd	nd	nd	nd
Subtotal All Except Compressor Engine	nd	nd	0.025	nd	nd	0.079
Compressor Engine (VRU)	0.0040	0.0037	0.0022	0.00094	0.029	nd
Total HAPs	0.0040	0.0037	0.027	0.00094	0.029	0.079

nd = no data provided by Noble Energy.

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Production Activities (Continued)

Vehicle Road dust

Per EPA AP-42 sec. 13.2.2-2

		PM-2.5	PM-10
Equation 1(a)	k (lb/VMT)		
(EPA 1996b)	a	0.15	1.5
	b	0.9	0.9
	s (silt content %)	0.45	0.45
	W = mean vehicle weight (tons)	5.1	

E = k (s/12)^a (W/3)^b

E = size specific factor (lb/VMT)

				Factor (lb/VMT)		Emissions (lb/yr)		Emissions (ton/yr)	
Vehicle	GVW (tons)	Round Trips	VMT	PM-2.5	PM-10	PM-2.5	PM-10	PM-2.5	PM-10
130 bbl water truck	42.5	231	462	0.229	2.289	52.884	528.839	0.0264	0.2644
200 bbl oil truck	37.5	250	500	0.216	2.164	54.099	540.992	0.0270	0.2705
Gas LDV - employee	2	365	730	0.058	0.579	21.120	211.200	0.0106	0.1056
Total								0.0641	0.6405

Control efficiency for watering 50%

Vehicle Exhaust

			Factors (g/VMT)*						Emissions (ton/yr)					
Vehicle	Round Trips	VMT	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
130 bbl water truck	231	462	11.44	14.74	5.69	n/a	n/a	0.32	0.0058	0.0075	0.0029			0.0002
200 bbl oil truck	250	500	11.44	14.74	5.69	n/a	n/a	0.32	0.0063	0.0081	0.0031			0.0002
Gas LDV - employee	365	730	0.65	9.66	0.56	n/a	n/a	n/a	0.0005	0.0078	0.0005			
Total									0.0126	0.0234	0.0065			0.0003

* Factors from AP-42 Volume II (EPA 1985)

Wind Erosion Emissions

Per EPA (1988), sec. 4.1.3

Equation 4-9

TSP (lb/acre/month) = 1.7 x (s/1.5) x ([365-p]/235) x (f/15) TSP (lb/acre/m 6.19

s = silt content = 5.1% 5.1

p = # of days with >0.001" precipitation = assumed zero (0) 0

f = percent of time wind speed > 5.4 m/s (12 mph) = 20.7% 20.7

50% controlled by watering 0.5

Particle aerodynamic size fractions, (ton PM10/ton TSP) 0.35

per sec. 4.1.1 (ton PM2.5/ton PM10) 0.1

Emissions (ton/yr)		
TSP	PM-10	PM-2.5
0.410	0.143	0.014

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Production Activities -- Compressor Engine Detail

Source Description	84 hp Unknown Unknown		Permit Status	GP02					
Source ID Number			Source Location				Stack Height		ft
Engine Usage	Compressor		Zone:				Stack Diameter		in
Engine Make	Unknown		Horizontal:				Exit Velocity		ft/s
Engine Model	Unknown		Vertical:				Exit Temperature		deg F
Serial Number			STR:				Volume Flow Rate		ft³/min
Date in Service									
Engine Type	4SRB	2SLB, 4SLB, or 4SRB	6 Heat Rate	0.66	MMBtu/hr		Emission Controls	NSCR	
ISO Rating	84	BHP	Fuel Heating Value	1300	Btu/scf				
Site Rating	84	BHP	Potential Operation	8760	hours/yr				
Fuel Consumption (BSFC)	7900	Btu/hp-hr	Potential Fuel Usage	4.47	MMscf/yr				
				0.5	mscf/hr				

Comments:

AP42 Data from Chapter 3.2, Table 3.2-3, Aug 2000				Man.	Uncntl			Uncontrolled / Potential			Man.		Cntl		Controlled / Actual		
AP42 Engine	**EF**	**EF**	**HAP**	**Uncntl EF**	**EF Used**			**Emissions**			**Cntl EF**	**Cntl**	**EF Used**		**Enforceable Emissions**		
Emission Data	**lb/MMBtu**	**g/hp-hr**	**% of VOC**	**g/hp-hr**	**in calc.**	**Units**	**Source**	**lb/hr**	**lb/yr**	**tpy**	**g/hp-hr**	**%**	**in calc.**	**Units**	**lb/hr**	**lb/yr**	**tpy**
NOx	2.210	7.92		12.00	12.0000	g/hp-hr	Man.	2.22	19467	9.73	2.00	83%	2.0000	g/hp-hr	0.37	3244	1.62
CO	3.720	13.33		12.00	12.0000	g/hp-hr	Man.	2.22	19467	9.73	4.00	67%	4.0000	g/hp-hr	0.74	6489	3.24
SO2	0.001	0.00			0.0006	lb/MMBtu	AP42	0.00	3	0.00		0%	0.0006	lb/MMBtu	0.00	3	0.0017
PM	0.010	0.04			0.0099	lb/MMBtu	AP42	0.01	58	0.03		0%	0.0099	lb/MMBtu	0.01	58	0.029
VOC	0.030	0.11		1.00	1.0000	g/hp-hr	Man.	0.19	1622	0.81	1.00	0%	1.0000	g/hp-hr	0.19	1622	0.81
Total HAPs	0.032	0.12	109.52%		0.0324	lb/MMBtu	AP42	0.02	188	0.09		0%	0.0324	lb/MMBtu	0.02	188	0.094
Formaldehyde	0.021	0.07	69.26%		0.0205	lb/MMBtu	AP42	0.01	119	0.06	0.01	51%	0.0100	lb/MMBtu	0.01	58	0.029
Acetaldehyde	0.003	0.01	9.43%		0.0028	lb/MMBtu	AP42	0.00	16	0.01		51%	0.0014	lb/MMBtu	0.00	8	0.0040
Acrolein	0.003	0.01	8.89%		0.0026	lb/MMBtu	AP42	0.00	15	0.01		51%	0.0013	lb/MMBtu	0.00	7	0.0037
Benzene	0.002	0.01	5.34%		0.0016	lb/MMBtu	AP42	0.00	9	0.00		51%	0.0008	lb/MMBtu	0.00	4	0.0022
1,3-Butadiene	0.001	0.00	2.24%		0.0007	lb/MMBtu	AP42	0.00	4	0.00		51%	0.0003	lb/MMBtu	0.00	2	0.0009
NMHC	0.128	0.46															
TOC	0.358	1.28															
Methane	0.230	0.82			AP-42 EF for uncontrolled NOx, CO, VOC and HAPs.												
VOC/NMHC			23.13%		CDPHE Reg 7 limits for NOx, CO, and VOC.												
VOC/TOC			8.27%		50% control of HAP emissions using NSCR.												
NMHC/TOC			35.75%														

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Production Activities -- Fugitive Emissions

Component Count for Single Well (Estimates only - not field verified)					
System	Component	Gas	Light Oil	Oil/Water	Heavy Oil
Separator	Valve	5	3	2	0
	Flange	10	5	5	0
	Connector	5	5	5	0
	Other	2	1	1	0
Compressor	Valve	15	0	2	5
	Flange	10	0	2	10
	Connector	2	0	1	3
	Other	1	0	1	1
Tanks	Valve	3	3	3	0
	Flange	6	3	3	0
	Connector	2	2	2	0
	Other	1	1	1	0
Flare System	Valve	2	2	0	0
	Flange	2	4	0	0
	Connector	1	1	0	0
	Other	1	1	0	0
Totals	Valve	25	8	7	5
	Flange	28	12	10	10
	Connector	10	8	8	3
	Other	5	3	3	1

Equipment Type	Emission Factor (lb/hr/source)[1]	Component Count[2]	Percent VOC[3]	Hours of Operation	Control Factor (Percent)	Total HC Emission Rate (lb/hr)	Total HC Emission Rate (tpy)	Total VOC Emission Rate (tpy)
Valves								
Gas	0.009921	25	26.40%	8,760	0.00%	0.2480	1.09	0.29
Light Oil	0.005511	8	100.00%	8,760	0.00%	0.0441	0.19	0.19
Heavy Oil	0.000019	5	100.00%	8,760	0.00%	0.0001	0.00	0.00
Water/Oil	0.000216	7	100.00%	8,760	0.00%	0.0015	0.01	0.01
Flanges								
Gas	0.000860	28	26.40%	8,760	0.00%	0.0241	0.11	0.03
Water/Oil	0.000006	10	100.00%	8,760	0.00%	0.0001	0.00	0.00
Light Oil	0.000243	12	100.00%	8,760	0.00%	0.0029	0.01	0.01
Other								
Gas	0.019400	5	26.40%	8,760	0.00%	0.0970	0.42	0.11
Water/Oil	0.030864	3	100.00%	8,760	0.00%	0.0926	0.41	0.41
Light Oil	0.016534	3	100.00%	8,760	0.00%	0.0496	0.22	0.22
Open-ended lines								
Gas	0.004409	0	26.40%	8,760	0.00%	0.0000	0.00	0.00
Pump Seals								
Light Oil	0.028660	0	100.00%	8,760	0.00%	0.0000	0.00	0.00
Connectors								
Water/Oil	0.000243	8	100.00%	8,760	0.00%	0.0019	0.01	0.01
Heavy Oil	0.000017	3	100.00%	8,760	0.00%	0.0000	0.00	0.00
Gas	0.000441	10	26.40%	8,760	0.00%	0.0044	0.02	0.01
Light Oil	0.000463	8	100.00%	8,760	0.00%	0.0037	0.02	0.02
Totals		135				0.5701	2.50	1.29

[1] Source: EPA 1995b

[2] Component counts are estimates only - not field verified

[3] Estimated VOC weight percent in gas streams

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Total Production Emissions and Percent of Weld County Inventory

Direct & Indirect Impacts

Production Emissions Description	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	HAPs (Benzene)
Proposed Action - per well	1.89	3.66	6.37	0.78	0.08	0.0003	0.0146
Proposed Action - total all wells*	2.16	4.08	11.93	1.57	0.16	0.0007	0.0269
Weld County (2010)	30,365	91,338	135,941	29,948	ND	545	354
Proposed Action % of Weld Co.	0.0071%	0.0045%	0.0088%	0.0052%	ND	0.00012%	0.00761%

Source for Weld County emissions: CDPHE 2013

* Total is less than per-well times no. of wells because there is only one compressor engine, which serves the output of all wells connected to the production facility. The engine exhaust emissions are included in the total for the first well only.

Comparison to CDPHE Modeling Thresholds

Emissions/Threshold Description	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X
Proposed Action - total all wells	2.16	4.08	11.93	1.57	0.16	6.8E-04
Requested Emission Rate from a New Source or Facility-Wide Net Emissions Increase from a Modification (tons/year)	40	100	No threshold	15	5	40

Source: CDPHE 2011

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Proposed Action CO_2e Comparison to States and U.S.

Geographic Area	Inventory CO_2e (10^6 tonnes/yr)	Project Total One-Time Emissions Plus One Year Production Emissions						Project % of Inventory	
		Project CO_2e (tons/yr)		Project CO_2e (tonnes/yr)		Project CO_2e (10^6 tonnes/yr)			
		1 Well	Prop. Action	1 Well	Prop. Action	1 Well	Prop. Action	1 Well	Prop. Action
Colorado (CDPHE 2007)	105.3	2,976	4,248	2,700	3,853	0.0027	0.0039	0.00256	0.00513
Utah (UDEQ 2007)	63.4							0.00426	0.00852
Wyoming (WDEQ 2007)	23.9							0.01130	0.02259
U.S. Total (EPA 2013)	5,797.3							0.00005	0.00009
U.S. fossil fuel combustion (EPA 2013)	5,325.7							0.00005	0.00010

Global Warming Potentials for CO2e Calculation (Forster et al. 2007)

Description	CO_2	CH_4	N_2O
100-year GWP	1	21	298

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Drill Rig Emission Factors (g/hp-hr)							
Rig Types	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_X	Notes
Natural Gas	1	2	0.7	n/a	n/a	n/a	4SLB
Diesel	2.5	2.6	0.3	0.075	0.075	0.0006	Tier 2 Voluntary Levels

Drilling Duration	
Well Type	Days/well
Horizontal	10
Vertical	5

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

Other Assumptions

Source: Noble Energy e-mails to ICF January 2014

Pneumatic devices are not included in the estimated fugitive counts. However, Noble does not use continuous bleed pneumatic devices. Pneumatic devices used are snap acting.

Pneumatic-related HAPs emissions were not estimated, but Noble does not use continuous bleed pneumatic devices. Pneumatic devices used are snap acting. So probably negligible HAPs.

Pneumatic pumps are portable and used where necessary. They are not standard for a location so are not included in emission estimates.

Blow down emissions are not included in any of the estimates provided. The newer wells are typically equipped with plunger lift systems based on a differential pressure. Once the pressure is reached, the valve opens and the plunger lifts the liquids to the surface. This helps eliminate the need to blow down a well to remove liquids from the well bore. Blow downs for well maintenance are not permitted or tracked per APCD guidance but are mitigated by reducing the pressure to the sales line prior to opening the well. Emission estimates can only be calculated on a "per event" basis and not until the depth, casing diameter, and pressure is known. The number of events during any one year is unknown.

Dehydration: no dehydrators at facility.

Separator flashing goes to the gas sales line, so no emissions.

HAPS emissions from "fugitive equipment leaks" were not estimated but could be ~0.1% of VOC emissions, so 2-3 lb per well per year – negligible.

Ethylbenzene, toluene and xylenes (T, EB, &X) in the production related gas streams were not estimated. Worst case would be to assume T, EB, & X emissions from "production related gas streams" are equal to Benzene.

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NOBLE ENERGY -- ENVIRONMENTAL ASSESSMENT FOR DP2 WELLS -- EMISSIONS CALCULATIONS FOR AIR QUALITY ANALYSIS

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APPENDIX B. NEAR-FIELD HAPS IMPACTS MODELING ASSESSMENT

A near-field ambient air quality impact assessment was performed to quantify and evaluate maximum pollutant impacts at nearby residences within the vicinity of the Project Area resulting from production related emissions. USEPA's recommended guideline model, AERMOD (version 12345), was used to predict near-field impacts. The near-field modeling analyses followed guidance and recommendations provided by Colorado APCD (CDPHE 2011) and EPA (EPA 2005).

Near-field modeling predicted maximum short-term (1-hour) and annual averaged ambient concentrations for the following hazardous air pollutants (HAPs): Benzene, Formaldehyde and n-Hexane.

Additional information for how the near-field modeling domain was established and setup is provided later in this report in section "Near-Field Modeling Setup and Emissions".

MODELING INPUTS AND METHODOLOGY

Meteorology

Meteorological surface data was collected from a National Weather Service (NWS) ASOS at Greeley, Colorado Airport (WBAN: 24051) located at 40.44N, 104.63W for five years (2008 – 2012). Data collected at the surface meteorological station for the creation of the near-field modeling dataset included numerous parameters such as wind speed, wind direction, temperature, relative humidity, cloud cover, atmospheric pressure, visibility, and precipitation. Upper air radiosonde data was collected by the National Weather Service in Denver, Colorado, located at 39.77N, 104.88W. The complete aggregation of raw monitored meteorological data values was processed by AERMET (version 12345) with monthly values for albedo, Bowen ratio, and surface roughness length derived specifically for the Greeley Airport to produce an AERMOD ready dataset.

Terrain

The local topography in the immediate area surrounding the Project-related emissions sources is relatively flat and therefore flat terrain is assumed for this modeling analysis; all elevations and heights for sources and receptors were set to zero in the modeling control file.

Downwash

A structure/building for the compressor engine was accounted for in this near-field impacts modeling analysis. The compressor engine point was centered on the structure with dimensions 10 m x 5 m x 3.7 m (height). The EPA's Building Profile Input Program for PRIME (BPIPPRM) was used to estimate the building dimensions and downwash values for input into AERMOD.

Near-Field Modeling Setup and Emissions

Near-field ambient air models were created with AERMOD to assess potential HAPs impacts from oil and gas production related activities. To realistically estimate potential near-field impacts for Project activity emissions, a production facility volume source (storage tanks and truck loading) and point source (compressor engine) were modeled together for the AERMOD modeling analysis. The applicant provided the emissions estimates for this analysis and the following tables show the emissions rates that were modeled. These emissions rates correspond to the output of five wells which is the number of wells the production facility is projected to serve.

The following table provides annual emissions rates divided up by modeling source group:

Table B-1. Annual Emissions

Emissions Source Type / Group*	Benzene	Formaldehyde	n-Hexane
total emissions for production facility volume source (TPY)	0.06175	0	0.39312
total emissions for production facility point source (TPY)	0.00224	0.02907	0
production facility total (TPY)	0.06399	0.02907	0.39312

*volume source: condensate and produced water storage tanks, and truck loading
*point source: compressor engine

The following table provides emissions rates that were input into AERMOD:

Table B-2. Emissions Rates Modeled

Emissions Source Type / Group*	Benzene	Formaldehyde	n-Hexane
emissions for production facility volume source (grams/sec)	0.0017764	0.0000000	0.0113089
emissions for production facility point source (grams/sec)	0.0000644	0.0008363	0.0000000

*volume source: condensate and produced water storage tanks, and truck loading
*point source: compressor engine

Figure B-1 shows the composite near-field modeling layout. This layout is based on industry provided spatial information for the O&G production facility.

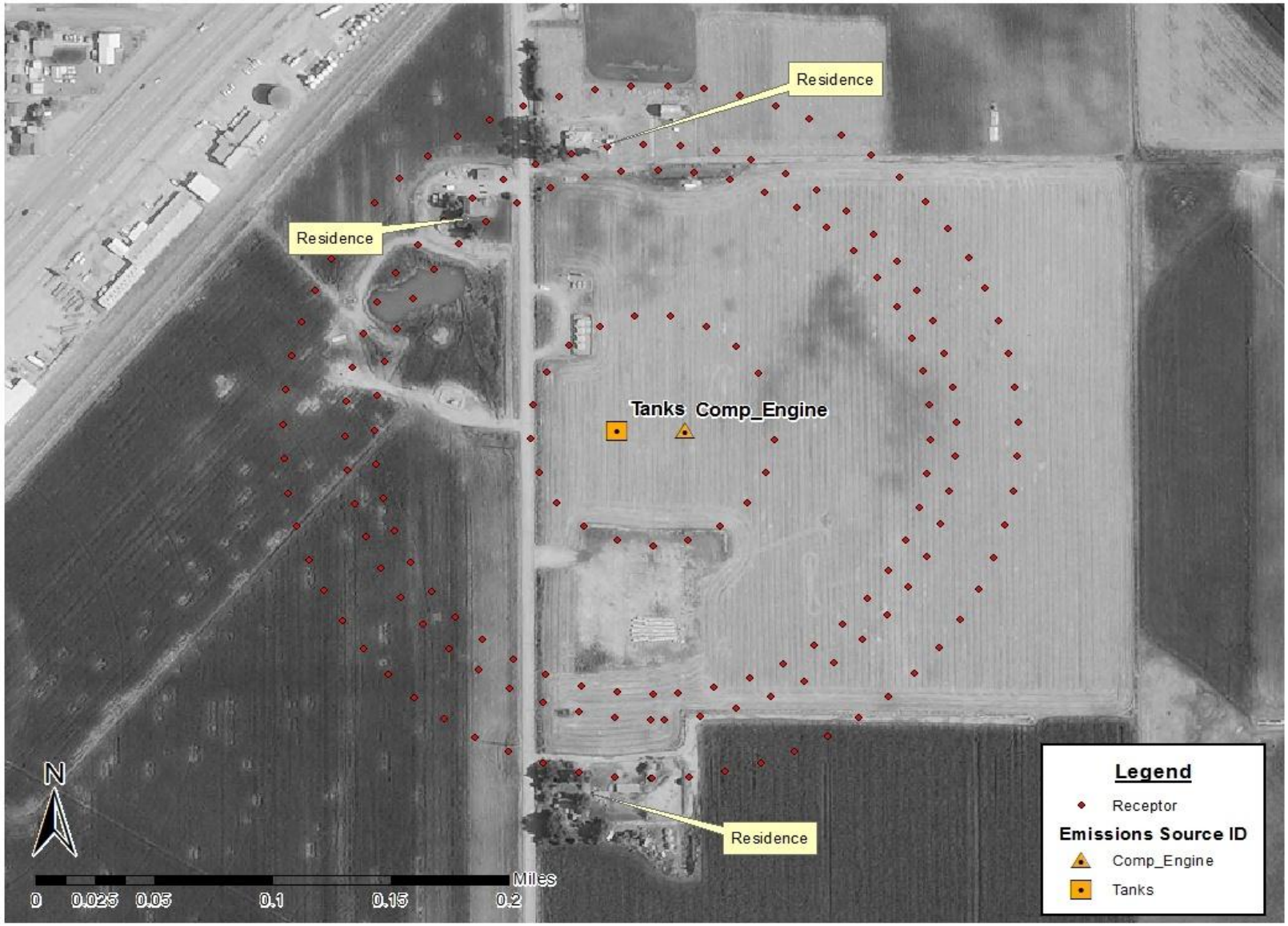
The following provides details about the emissions sources that were included in the near-field modeling and any additional information about how the emissions were released / modeled within the near-field modeling domain:

- Well pad production combustion source: accounts for compressor engine. Emissions released from "operating" point source with stack height: 6.2 meters, exhaust temperature: 675 K, exit velocity: 30 meters/second and stack tip diameter: 0.2 meters.
- Well pad production non-combustion / fugitive sources: accounts for production storage tanks and truck load-out activities. Emissions were distributed to a facility volume source with a release height: 2.29 meters, sigma-y: 1.42 meters and sigma-z: 2.13 meters.

The following outline provides details about the near-field receptor grid surrounding the emissions sources. The receptor network is shown in Figure B-1.

- Three residences are near the O&G production facility: two residences to the north (~ 180-200 meters from emissions sources) and one residence to the south (~ 250 meters from emissions sources).
- Four receptor rings were established surrounding the facility emissions sources with 25 meter spaced receptors along the rings. There are three rings that put receptors at the residences and one ring that puts receptors along the nearby public road (see Figure B-1).

Figure B-1. Near-Field Modeling Layout



NEAR-FIELD ASSESSMENT OF AIR QUALITY IMPACTS

Ambient Air Background Concentration Data

Background pollutant concentration data collected at a regional monitoring site that are provided in the EPA Air Quality System (AQS) database (EPA 2014) are shown in the following table. Table B-3 provides the background HAPs concentrations and describes the location and data source of each concentration value. Pollutant concentrations in micrograms per cubic meter ($\mu g/m^3$) are shown for all pollutants. These background concentrations could represent all non-Project near-field emissions sources impacts and be added to the near-field modeled concentrations to produce cumulative predicted near-field concentrations for comparison to applicable air quality impact thresholds.

The following Table B-3 shows HAP monitored concentrations for the Rifle, Colorado monitor (08-045-0007) that is located in a high oil and gas development area similar to that of the Project location. There is no monitored data in the near vicinity of the Project area, but it is reasonable to assume that the existing background ambient HAPs concentrations in the Project area would be similar to the values shown in the table below.

Table B-3. Ambient Background Concentrations

Pollutant / Units	Background Monitored Concentrations (Year 2012)		Monitoring Station Information
	1-Hour	Annual Average	
Benzene (⍰g/m^3)	18.34	5.97	Garfield County, Colorado (Rifle, Colorado). Monitor ID: 08-045-0007. 1-hour value is maximum for all reported concentrations in year 2012 dataset. Annual average value is average of all values in the year 2012 dataset.
Formaldehyde (⍰g/m^3)	2.80	1.39	Garfield County, Colorado (Rifle, Colorado). Monitor ID: 08-045-0007. 1-hour value is maximum for all reported concentrations in year 2012 dataset. Annual average value is average of all values in the year 2012 dataset.
n-Hexane (⍰g/m^3)	66.97	18.33	Garfield County, Colorado (Rifle, Colorado). Monitor ID: 08-045-0007. 1-hour value is maximum for all reported concentrations in year 2012 dataset. Annual average value is average of all values in the year 2012 dataset.

$\mu g/m^3$ = micrograms per cubic meter

HAPs Impacts Analysis

Short-term (1-hour) HAP concentrations were compared to acute Reference Exposure Levels (RELs), shown in Table B-4. RELs are defined as concentrations at or below which no adverse health effects are expected. No REL is available for n-hexane; instead, the available Immediately Dangerous to Life or Health divided by 10 (IDLH/10) values are used. These IDLH values were determined by the National Institute for Occupational Safety and Health (NIOSH) and were obtained from USEPA's Air Toxics Database (EPA 2011). These values approximate pollutant concentrations likely to produce mild effects during 1-hour exposures.

As shown in Table B-4, all HAP maximum 1-hour concentrations (with inclusion of background concentrations) for all receptors are well below the REL or IDLH/10 reference concentrations. Maximum 1-hour benzene concentration is approximately 3.3% of REL, formaldehyde maximum 1-hour

concentration is approximately 5.9% of REL and maximum 1-hour n-hexane is approximately 0.1% of its REL.

Table B-4. 1-Hour HAP Maximum Concentration Comparison to RELs

HAP	Modeled Year	Maximum 1-Hour Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$) [a]	Maximum Total Concentration ($\mu g/m^3$)	REL ($\mu g/m^3$)	Percent of REL (%)
Benzene	2008	22.87	18.34	41.21	1,300 [b]	3.2
	2009	22.56	18.34	40.90		3.1
	2010	22.71	18.34	41.05		3.2
	2011	22.71	18.34	41.05		3.2
	2012	24.83	18.34	43.17		3.3
Formaldehyde	2008	0.46	2.80	3.26	55 [b]	5.9
	2009	0.45	2.80	3.25		5.9
	2010	0.45	2.80	3.25		5.9
	2011	0.46	2.80	3.26		5.9
	2012	0.44	2.80	3.24		5.9
n-Hexane	2008	145.59	66.97	212.56	390,000 [c]	0.1
	2009	143.61	66.97	210.58		0.1
	2010	144.58	66.97	211.55		0.1
	2011	144.58	66.97	211.55		0.1
	2012	158.05	66.97	225.02		0.1

$\mu g/m^3$ micrograms per cubic meter
REL Reference Exposure Level

[a] Background concentrations developed from EPA AQS data. (EPA 2014).
[b] USEPA Air Toxics Database, Table B-2 (EPA, 2011).
[c] No REL available for these HAPs. Values shown are from Immediately Dangerous to Life or Health (IDLH/10), USEPA Air Toxics Database, TableB-2 (EPA, 2011).

Long-term maximum potential exposure to HAPs are compared to Reference Concentrations for Chronic Inhalation (RfCs) in Table B-5. An RfC is defined by USEPA as the daily inhalation concentration at which no long-term adverse health effects are expected. RfCs exist for both non-carcinogenic and carcinogenic effects on human health (EPA, 2012). Annual modeled HAP concentrations for each modeled HAP were compared directly to the non-carcinogenic RfCs shown in Table B-5. The maximum modeled benzene, formaldehyde and n-hexane concentrations for all receptors are approximately 1.4 - 21.5 percent of their respective RfCs.

Table B-5. Annual Average Predicted Concentrations Compared to RfCs

Pollutant	Year	Annual Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$) [a]	Maximum Total Concentration ($\mu g/m^3$)	RfC [b] ($\mu g/m^3$)
Benzene	2008	0.41	5.97	6.38	30
	2009	0.49	5.97	6.46	

Table B-5. Annual Average Predicted Concentrations Compared to RfCs

Pollutant	Year	Annual Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$) [a]	Maximum Total Concentration ($\mu g/m^3$)	RfC [b] ($\mu g/m^3$)
	2010	0.46	5.97	6.43	
	2011	0.46	5.97	6.43	
	2012	0.45	5.97	6.42	
Formaldehyde	2008	0.02	1.39	1.41	9.8
	2009	0.01	1.39	1.40	
	2010	0.01	1.39	1.40	
	2011	0.01	1.39	1.40	
	2012	0.01	1.39	1.40	
n-Hexane	2008	2.61	18.33	20.94	200
	2009	3.13	18.33	21.46	
	2010	2.92	18.33	21.25	
	2011	2.95	18.33	21.28	
	2012	2.85	18.33	21.18	

$\mu g/m^3$ micrograms per cubic meter
RfC Reference Concentration for Chronic Inhalation

[a] Background concentrations developed from EPA AQS data. (EPA 2014).
[b] USEPA Air Toxics Database, Table B-1 (EPA, 2012).

Of the above HAPs, only benzene and formaldehyde are suspected to be carcinogenic. RfCs for these HAPs are expressed as unit risk factors (URFs) and are shown in Table B-6. Accepted methods for risk assessment were used to evaluate the incremental cancer risk for these pollutants. Based on the Superfund National Oil and Hazardous Substances Pollution Contingency Plan, a cancer risk range of 1 in a million to 100 in a million (10^{-6} to 10^{-4} risk) is generally acceptable (EPA 1990). Cancer risks for each individual HAP and for combined exposure to aggregated HAPs for both the maximally exposed individual (MEI) and most likely exposure (MLE) are within or below this range. A detailed explanation of this determination is provided below.

Annual total concentrations (modeled plus background) were multiplied by USEPA's URF (based on 70-year exposure) for those pollutants, and then the product was multiplied by an adjustment factor that represents the ratio of projected exposure time to 70 years. The adjustment factors represent two scenarios: a MLE scenario and one reflective of the MEI.

The MLE duration was assumed to be 9 years, which corresponds to the mean duration that a family remains at a residence (EPA 1993). This duration corresponds to an adjustment factor of 9/70 = 0.13. The duration of exposure for the MEI was assumed to be 20 years (i.e., the LOP), corresponding to an adjustment factor of 20/70 = 0.29.

A second adjustment was made for time spent at home versus time spent elsewhere. For the MLE scenario, the at-home time fraction is 0.64 (EPA 1993), and it was assumed that during the rest of the day the individual would remain in an area where annual HAP concentrations would be one-quarter as large as the maximum annual average concentration. Therefore, the MLE adjustment factor was (0.13) × [(0.64 × 1.0) + (0.36 × 0.25)] = 0.095. The MEI scenario assumed that the individual is at home 100 percent of the

time, for a final adjustment factor of (0.29 × 1.0) = 0.29. USEPA URFs and adjustment factors are shown in Table B-6.

Cancer risk from benzene, formaldehyde, and the combined HAPs (benzene plus formaldehyde) are shown in Table B-6. For the MLE, an individual could encounter a maximum cancer risk due to benzene of up to 4.79 in one million. The MLE risk due to formaldehyde is 1.74 in a million. The combined HAPs MLE risk is approximately 6.5 in one million. Cancer risks are greater for an MEI, with a risk of up to 14.6 (in one million) due to benzene exposure and up to 5.3 (in one million) for formaldehyde exposure.

Table B-6. Cancer Risk From Long-Term Exposure

HAP	Year	Analysis	Carcinogenic RfC URF [a] 1/(µg/m^3)	Exposure Adj. Factor	Cancer Risk (per million)
Benzene	2008	MLE	7.8×10^{-6}	0.095	4.73E-06
		MEI	7.8×10^{-6}	0.29	1.44E-05
	2009	MLE	7.8×10^{-6}	0.095	4.79E-06
		MEI	7.8×10^{-6}	0.29	1.46E-05
	2010	MLE	7.8×10^{-6}	0.095	4.76E-06
		MEI	7.8×10^{-6}	0.29	1.45E-05
	2011	MLE	7.8×10^{-6}	0.095	4.77E-06
		MEI	7.8×10^{-6}	0.29	1.46E-05
	2012	MLE	7.8×10^{-6}	0.095	4.76E-06
		MEI	7.8×10^{-6}	0.29	1.45E-05
Formaldehyde	2008	MLE	1.3×10^{-5}	0.095	1.74E-06
		MEI	1.3×10^{-5}	0.29	5.30E-06
	2009	MLE	1.3×10^{-5}	0.095	1.73E-06
		MEI	1.3×10^{-5}	0.29	5.28E-06
	2010	MLE	1.3×10^{-5}	0.095	1.73E-06
		MEI	1.3×10^{-5}	0.29	5.28E-06
	2011	MLE	1.3×10^{-5}	0.095	1.73E-06
		MEI	1.3×10^{-5}	0.29	5.28E-06
	2012	MLE	1.3×10^{-5}	0.095	1.73E-06
		MEI	1.3×10^{-5}	0.29	5.28E-06
Total Combined	**2008 to 2012**	**MLE**			**6.52E-06**
		MEI			**1.99E-05**

MEI maximally exposed individual
µg/m^3 micrograms per cubic meter
MLE most likely exposure
URF unit risk factor

[a] USEPA Air Toxics Database, Table B-1 (EPA 2012).

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